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Oviducal Fertilization in the South American Catfish, *Trachycorystes*

By Rodolpho von Ihering

THE Commissão Technica de Piscicultura recently made an ecological study of several species of fishes, including the catfish, *Trachycorystes*, which is rather abundant in some of the artificial lakes of northeastern Brazil, and is esteemed as food. The study of *Trachycorystes*, which has a peculiar method of reproduction, was made by Dr. Luis Canale, but as he is no longer doing biological work, the writer presents his own observations, pending a more comprehensive investigation.

In brief, reproduction in *Trachycorystes* differs from the usual type in that the spermatozoa are introduced into the oviduct before the maturation of the ova, and fertilization takes place at the time of spawning, independently of the male. The act of insemination was not observed, but the essential facts can be gained from a study of morphological details and spawning behavior.

Trachycorystes striatulus Steindachner[1] reaches a length of 25 cm. and a weight of 300 to 400 g. The females, in general, are somewhat longer than the males. In the fry, the anal fin is similar in the two sexes, but at the end of 3 or 4 months, at a length of about 12 cm., the genital aperture of the male has migrated from the base of the first anal fin ray toward its distal part. At this age, the male gonads measure 40 mm. in length, and there is no macroscopic evidence of a differentiation in the 30 or more lobes of each side. However, the basal part is somewhat tumid.

In the adult male, the genital aperture is situated at the apex of the anal fin, and a sound may be passed internally to a median vesicle which is connected with the gonads. The gonads have two parts:

1. The anterior part, where the spermatozoa are formed and retained until used. In this portion there are 24 to 28 lobules in the form of slightly compressed cones, almost twice as large near the vesicle as at the free end. In general there are groups of two or three lobules, joined at the bases and placed in two irregular series over a membrane. The lobules are white, with distinct red spots. It was not possible to verify, by means of a fine sound, the presence of canals leading from the lobules to the duct of the pseudopenis.
2. The posterior part, at either margin of the median vesicle, composed of 9 to 11 tumid cones arranged in a single series. These are uniformly red and contain only gelatinous substance.

The median vesicle, to which the posterior part of the testes are attached, has a complicated structure. It is formed of delicate membranes which inclose gelatinous fusiform bodies grouped in bundles. In a transverse section are seen circles of membranes containing gelatinous substance. These are bound together into bundles by membrane. It seems that the posterior portion of the vesicle is more gelatinous and less well defined in the internal structure than the anterior portion. In the posterior and middle parts, the vesicle is

[1] We agree with Starks (1913) in regarding as insignificant the supposed difference between this species and *T. galeatus*. The head of thin or preserved specimens is always rougher than that of fat ones.

distinctly divided into right and left halves, but the separation becomes progressively less distinct, until at the extreme anterior end the two sides are confluent; and the internal elements are much smaller than in the middle and posterior parts. The two separated halves are somewhat ovoid in form, but the whole, invested by a common membrane, is irregularly spherical. The vesicle communicates with the excretory canal, which is prolonged to the apex of the anal fin.

The spermatozoon of this fish differs from that of others in appearance as well as in behavior. It is very long, with a robust head and slender flagellum. In the spermatic fluid, its movement is rather slow and sometimes rectilinear; but placed in water, it immediately becomes deformed, usually drawing up the extremity into the form of a hook. Normally a preparation of sperm shows a radial arrangement.

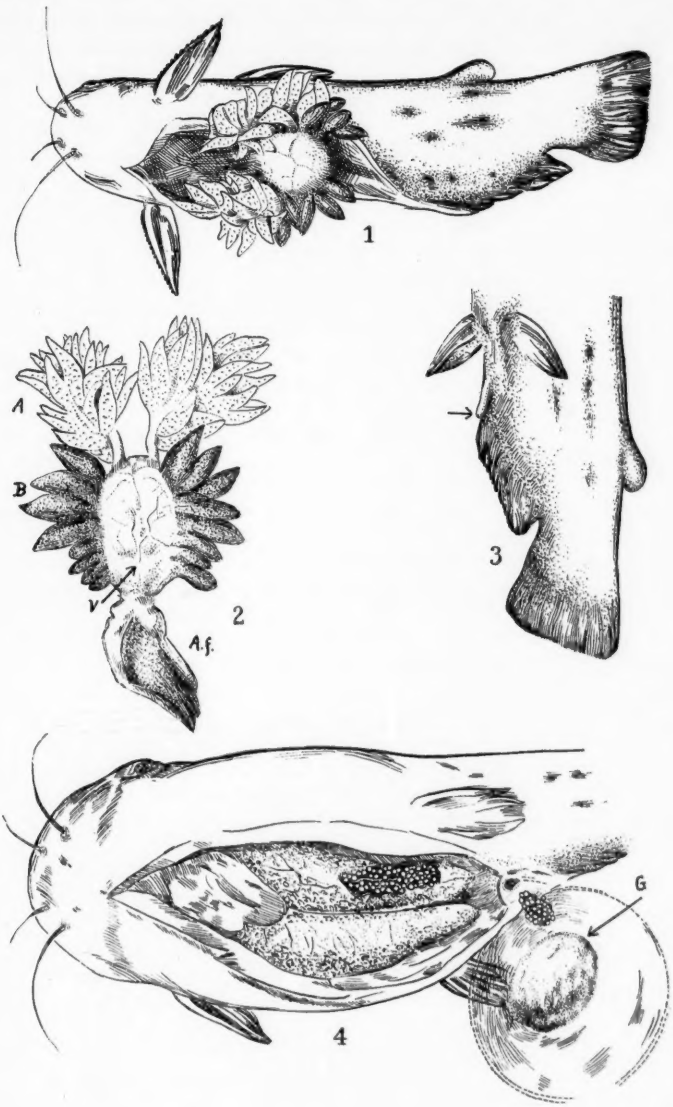
In the female, the only peculiarity is the enlargement of the oviduct to form a "uterus simplex." The ovaries are rather short and stout.

The eggs are not essentially different from those of other Nematognathi seen by us (*Rhamdia* and *Pimelodella*). In contact with water, a yellowish, gelatinous envelope is soon formed. One peculiarity concerns the change in the shape of the egg mass. At first it is reniform or lenticular, but later gives off a vacuolated pseudopod which increases in size until the whole is spherical, a process consuming about 20 minutes. In an article to be published in the *Zoologischer Anzeiger*, we mention this fact and the curious movement of the egg-contents during development, which was noted also for the egg of *Hoplias* (Characidae).

The structural peculiarities of the genital organs are related to special behavior in reproduction. Relatively early, before other species are ready for reproduction, the male introduces the milt and a large gelatinous plug into the oviduct of the female. This act has not been observed. When we examined females in March, 1937, all had the ovaries more or less developed and the oviducts contained abundant gelatin, weighing 2.5 g. When pressed, the males gave off a string of gummy or pasty gelatin, which soon became a uniform mass. It was insoluble in water, did not harden in air, and after a time liquefied and decomposed. Under the microscope, the gelatin is fully transparent, colorless and amorphous. Material removed from the oviduct shows a mixture of sperm and gelatin in the zone of contact, but most of the milt remains separated.

The females remain in this condition, according to our observations, for at least 4 months. On March 12, we found developing eggs attached to vegetation, and at the same time, fry of 10 mm. in length and about 7 days old. In aquaria, some females were kept from March until June, when the last of them spawned following an injection with extract of pituitary; but no females spawned spontaneously in captivity, even though subjected to various environmental conditions. It is clear, in this respect, that *Trachycorystes* behaves like other common fishes of this region, spawning only under certain meteorological conditions, in contrast to the viviparous cyprinodonts, in which gestation may take place in any month of the year.

The females injected with pituitary extract spawned regularly after an interval of 20 hours, except in a few experiments modified by evident dis-



Figs. 1–4. Genital Organs of *Trachycorystes.*

Fig. 1. *T. striatulus,* adult male, showing testes in position.
Fig. 2. *T. striatulus:* testes, showing (A) sperm-producing lobes, and (B) gelatin-producing lobes, (v) vesicle full of gelatin, and (A.f.) anal fin, with pseudopenis and aperture.
Fig. 3. Tail of juvenile male, showing incompletely developed pseudopenis.
Fig. 4. Female, showing mature eggs and gelatin plug (G). The latter is shown contained in a watch glass.

turbing factors. As these fish were already provided with sperm, the presence of males was not required. Eggs removed from the female before injection did not develop, but those collected after spawning initiated by the hypophysation method, were all fertilized and developed normally.

After June, the females kept in aquaria lost the gelatinous plug, and the gonads in both sexes diminished greatly in volume.

Further considerations of the details of behavior will be left until a study of the life history has been completed. Abundant material has been sent to Dr. C. L. Turner, Northwestern University, who will make a detailed histological study of the gonads.

Considering the anatomical and physiological peculiarities of *Trachycorystes,* the idea presents itself that, from an evolutionary point of view, the species may be in the process of transformation to viviparity. The marked morphological changes in the male appear to be of recent origin, for the pseudopenis does not reach full development until the fish has attained more than three-fourths of its normal adult length. The posterior portion of the testes, although not greatly modified in gross morphology, having the characteristic aspect of all nematognaths, is completely changed in function (metergy), producing a gelatinous substance instead of sperm. The most fundamental change in our opinion is in the spermatozoa, which, in contrast to those typical of oviparous fishes, lose their motility in water. In the female, it seems that the only modification is a simple enlargement of the oviduct. The curious movement of the contents of the egg, mentioned above, appears to be quite independent of the other adaptations described.

The males in the genera *Asterophysis, Pseudauchenipterus, Auchenipterichthys, Tatia,* and probably *Ceratocheilus,* also have a pseudopenis, so it may be supposed that this method of reproduction can be investigated in no less than 30 species. Eigenmann (1925) places all these genera along with 7 others in the family Auchenipteridae. Miranda Ribeiro (1911) more properly groups them in the family Trachycorystidae, including also *Centromochlus, Glanidium* and others, which have males with normal genital opening. Entirely inacceptable is the inclusiveness given by Jordan[2] to the family Doradidae. Retaining the general arrangement of Jordan for the order Nematognathi, there should be separated from the Doradidae, the families Ageneiosidae and Auchenipteridae, the latter with 2 subfamilies, Auchenipterinae, with normal fecundation, and Trachycorystinae, with oviducal fecundation.

The subfamily Trachycorystinae appears to have had its origin in the Amazon region, where all 5 genera are represented, 3 being limited to this hydrographic system. *Pseudauchenipterus* has a wider distribution, reaching Río São Francisco and the coastwise streams of southeastern Brazil. *Trachycorystes* has been dispersed much more widely, reaching the Río de la Plata system, going down Río Paraguay and up Río Paraná, probably to Salto de Sete Quedas (Guaira); but, so far as we know, only one species, *T. striatulus,* has been able to pass this barrier, to the headwaters of Río Paraná in the state of São Paulo. This distribution agrees with that of the Doradidae as given by Eigenmann (1925: Fig. 15). His map shows a question mark for Río Paraná above Salto de Sete Quedas, but during our investigations

[2] Classification of Fishes, 1923.

in Río Mogy-Guassú, we collected *Rhinodoras dorbignyi* Kröyer, the distribution of which is thus exceptional, corresponding with that of *T. striatulus*. For northeastern Brazil, Eigenmann did not report Doradidae, and we also have taken no species of this family anywhere between Río Parnahyba and São Francisco. Of the Trachycorystidae, we have here *T. striatulus*, and another, *T. cratensis*, recently described by Miranda Ribeiro (1937) from the southern part of the state of Ceará. They are doubtless relics of a formerly richer fauna, perhaps equivalent to that of Río São Francisco, reduced to its present poverty by adverse climatic conditions which gave the characteristics of a steppe to approximately 670,000 square kilometers in northeast Brazil.

Let us consider from another point of view the peculiar reproductive behavior of *Trachycorystes*. With respect to final maturation and subsequent spawning, the female behaves like all other fishes of the region. As it has been fecundated previously, at least some weeks before, spawning is clearly not the result of sexual stimulation, as may be true in other species. Obviously, then, the initial stimulus for maturation of the eggs depends only upon some environmental factor.

When we inject the female with pituitary extract (von Ihering and de Azevedo, 1936), we change the natural conditions. We obviate that phase in reproduction of external stimulation, and enter at once into the second phase, which involves actuation by a hormone. This leads us to believe in the possibility of a more simple method of inducing spawning of fishes. All that is necessary is to determine the external actuating factor, and to establish identical conditions artificially so that the pituitary of the fish itself will provide the hormone which we now inject.

From papers of the Moscow Institute of Ionization, prepared under the direction of Prof. A. L. Tchijevski, we were led to believe that the external factor might be ionization. Prof. Tchijevski and several North Americans were consulted, and agreed that the hypothesis is plausible.

Investigation is needed also to determine the stimulus that provokes early copulation, before the eggs of the females have matured.

Literature Cited

Eigenmann, C. H.

1925 A review of the Doradidae. *Trans. Am. Phil. Soc.* (n.s.): 21.

Ihering, R. von, and P. de Azevedo

1936 A desova e a hypophysação dos peixes; Evoluçao de dois nematognathas. *Arch. Inst. Biol., S. Paulo*, 7: 107 pp.

Miranda Ribeiro, A.

1911 Fauna Brasiliense. Peixes. *Arch. Mus. Nac. Rio de Janeiro*, 16.

1937 Sobre uma colleccion de vertebrados do Nordeste Brasil. O. Campo. *(Revista Agricola), Rio de Janeiro*, Jan., 1937: 55.

Starks, E. C.

1913 The fishes of the Stanford Expedition to Brazil. *Stanford Univ. Publ. (Univ. Ser.)*, 1913: 31.

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Modification of the Sexual Cycle in Trout by Control of Light[1]

By Earl E. Hoover and Harry E. Hubbard

THE work of Rowan (1926, 1930), Bissonnette (1930, 1932, 1935) and others on the manipulation and control of sexual cycle in birds by the use of light is well known. Bissonnette (1935a, 1935b) further extended his work to include mammals, and Bissonnette and Csech (1936a, 1936b) used "night-lighting" in a practical manner to procure eggs from game birds during the winter. As far as known, fish have not received any similar attention experimentally, but as early as 1926 Rowan, from his work on birds, pointed out that the migrations of anadromous fishes might be influenced by the length of day. Hoover (1937) in a preliminary note of which this paper is a full discussion reported some light effects on trout.

Experiments with Trout

During December, 1936, sixty brook trout, *Salvelinus fontinalis*, which were then (Dec. 17) ripe, hence a late spawning strain, were selected and placed in 3 aquaria (20 fish in each) at the New Hampton Hatchery of the New Hampshire Fish and Game Department. It was believed that the fish would have to become acclimated and some time was needed to carry them over an assumed refractory period in the sexual cycle. All experiments on brook trout were started on February 2, 1937. The 3 aquaria, each with 20 fish, received similar care; the temperature in all 3 was uniform at all times (water averaged 44.8° F. or 7° C., minimum 41° F. or 5° C., maximum 50° F. or 10° C.). Into each was put the same quality and quantity of food. The ratio of volume of fish to volume of water was kept as nearly equal in all aquaria as possible. Water was introduced from a common water supply, and conveyed by a single pipe with an outlet for each aquarium.

Light Treatment

A 25 Watt mazda and a 16 cp. carbon filament bulb in a white reflector were suspended over the 2 experimental aquaria. The lights were turned off and on by an electric time switch, regulated to control the light as indicated in the table below. The hours of light for both experimental groups of trout (A and B) were increased the first week of the experiment by one hour a day over the normal daylight period for that season at 44° latitude as given by the United States Sunshine Tables (Marvin, 1905). Each succeeding week, one more hour was added to the daily total, until the excess over the normal light period reached 8 hours. The light was maintained at that level for 4 weeks (Fig. 1 and Table, 13 to 16 weeks), after which the excess lighting was gradually diminished in both aquaria until the normal length of day had been reached (23rd week). Thereafter the two groups of experimental fish (A and B) were treated differently (see Table, beginning 24th week of year).

Experimental group A was treated as follows: Beginning with the 24th

[1] Published under a grant from the American Wildlife Institute for the publication of contributions fundamental to fish management.

week, the aquarium was covered with a light-proof box for gradually increasing periods, until the average day's light period was reduced to approximately 7 hours at the completion of the experiment.

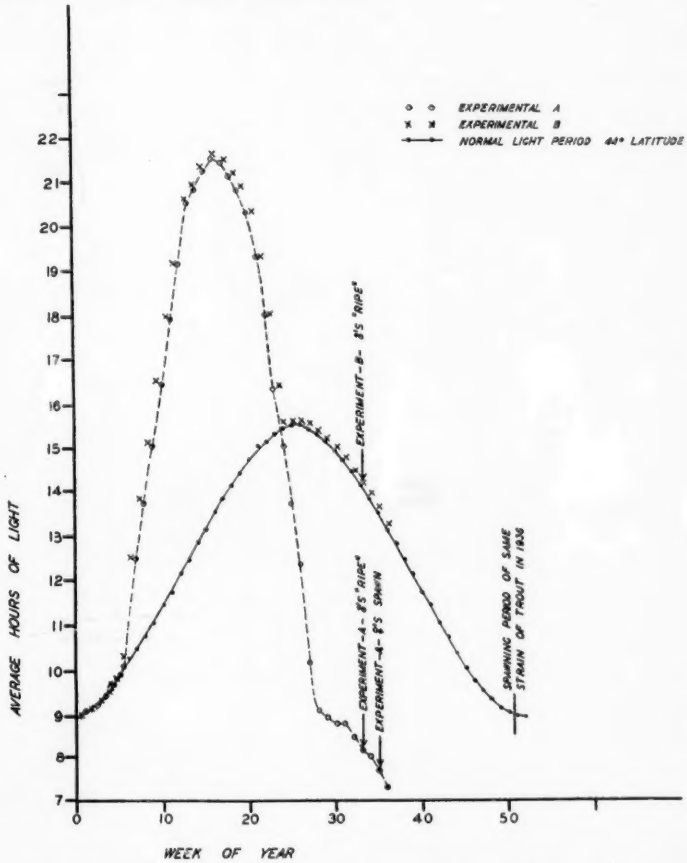

Fig. 1. Showing normal average hours of light a day (solid line, dots) compared with experimental modifications (broken line, circles and crosses). Averages are by weeks.

The light for Experimental group B, on the other hand, was not further modified after it had reached the daylight period normal for latitude 44° N., viz., beginning with the 24th week. As the length of day began to decrease after the 27th week, this group of fish received a corresponding decrease in total number of daylight hours.

Results

Periodically pairs of fish were taken from each of the three tanks. The gonads were removed and those of the experimental fish were compared

with those of the controls, and of wild fish. The gonads of the control fish remained normal during the entire experiment and at all times were comparable with those of wild fish. The gonads of the experimental fish (in both A and B) appeared larger than those of the control fish during the latter

TABLE 1. NORMAL AND MODIFIED AVERAGE HOURS OF LIGHT A DAY. AVERAGES ARE BY WEEKS.

		Normal or Controls	Experiment A		Experiment B	
Week	Date	Av. length day 44° Lat.	Av. length of day	Av. + or − light hrs.	Av. length of day	Av. + or − light hours
1	Jan. 1– 4	9.0				
2	5–11	9.1				
3	12–18	9.3				
4	19–25	9.5				
5	26– 1	9.8				
6	Feb. 2– 8	10.2	11.2	+1.0	11.2	+1.0
7	9–15	10.4	12.4	+2.0	12.4	+2.0
8	16–22	10.7	13.7	+3.0	13.7	+3.0
9	23– 1	11.0	15.0	+4.0	15.0	+4.0
10	Mar. 2– 8	11.4	16.4	+5.0	16.4	+5.0
11	9–15	11.7	17.7	+6.0	17.7	+6.0
12	16–22	12.1	19.1	+7.0	19.1	+7.0
13	23–29	12.4	20.4	+8.0	20.4	+8.0
14	30– 5	12.8	20.8	+8.0	20.8	+8.0
15	Apr. 6–12	13.1	21.2	+8.1	21.2	+8.1
16	13–19	13.5	21.5	+8.0	21.5	+8.0
17	20–26	13.8	21.4	+7.6	21.4	+7.6
18	27– 3	14.1	21.1	+7.0	21.1	+7.0
19	May 4–10	14.4	20.7	+6.3	20.7	+6.3
20	11–17	14.7	20.4	+5.7	20.4	+5.7
21	18–24	15.0	19.5	+4.5	19.5	+4.5
22	25–31	15.1	17.9	+2.8	17.9	+2.8
23	June 1– 7	15.3	16.3	+1.0	16.3	+1.0
24	8–14	15.4	15.0	−0.4	15.4	
25	15–21	15.5	13.7	−1.8	15.5	
26	22–28	15.5	12.3	−3.2	15.5	
27	29– 5	15.4	11.0	−5.4	15.4	
28	July 6–12	15.3	8.9	−6.4	15.3	
29	13–19	15.1	8.9	−6.2	15.1	
30	20–26	14.9	8.8	−6.1	14.9	
31	27– 2	14.7	8.7	−6.0	14.7	
32	Aug. 3– 9	14.4	8.4	−6.0	14.4	
33	10–16	14.1	8.1	−6.0	14.1	
34	17–23	13.8	7.8	−6.0	13.8	
35	24–30	13.5	7.5	−6.0	13.5	
36	31–	13.1	7.1	−6.0	13.1	

part of the experiment (May-August). On July 11 (Fig. 2) the ovaries of the experimental fish were distinctly larger than those of the controls. Unfortunately the trout were not examined again until August 12 when all of the males (10) in Tank A were found to be sexually active and ejected copious quantities of spermatozoa when stripped in the usual hatchery manner; females in this aquarium had distended vents. Three out of ten males in Tank B were "ripe," but the females did not show any evidence of sexual activity. As males in the wild commonly reach full sexual activity a week or two before the females, the experimental fish were again studied on August 31, when the females in Tank B were found to be ripe." The females were stripped

and the eggs fertilized. The eggs were smaller than usual (419 to the ounce as compared to approximate normal of 350 to the ounce) but began normal development when placed in the hatchery troughs. Of further interest is the fact that several albino trout were included in the experiment (Group B). The albino males were found to be "ripe" on August 31. The lack of pigmentation did not prevent them from responding to light treatment.

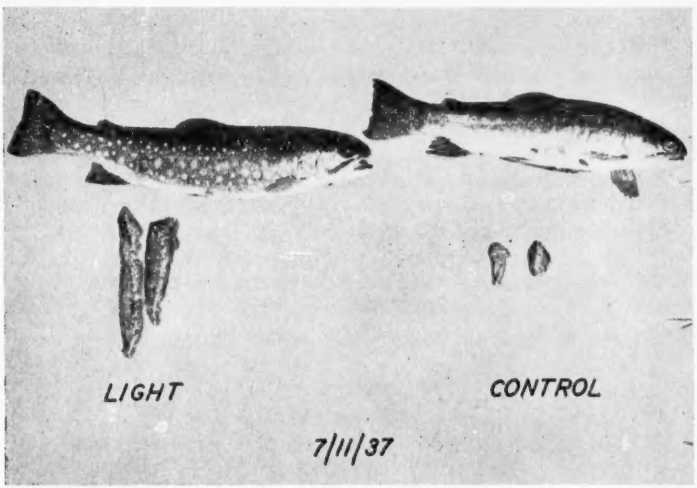

Fig. 2. Female trout killed and dissected on July 11. The ovaries of the light treated fish are obviously larger than those of the controls.

Discussion

Brook trout, *Salvelinus fontinalis,* normally spawn during October, November, and December in New Hampshire. If late spawning in trout is a characteristic which is retained from year to year by a specific strain of fish, the experimental strain of trout (spawning in December, 1936) were induced to spawn 4 months in advance of their normal spawning period. If late spawning is not a permanent characteristic, the trout spawned approximately a month before any trout normally reach sexual maturity in this state. These facts will be ascertained by further experimentation.

Experiments on plants are of interest in that they permit a general classification into types which show definite relations between the length of day and sexual activity. Bissonnette (1935a) summarizes this work ". . . plants fall into 3 classes: . . . (1) Short-day plants, blooming when days become shorter; (2) Long-day plants, blooming when days become longer than a critical length; (3) Ever-blooming plants, blooming without definite relation to day-night ratio or within very broad limits of day-length." Fish or mammals might be similarly classified: (1) sheep, deer, brook trout and landlocked salmon breed as the days become shorter; (2) raccoons, foxes, some catfish and black bass as the days become longer; and (3) cats, dogs and some aquaria fishes without demonstrated relation to the length of day.

It seems, however, that fish should be far more limited by temperatures than warm blooded animals. It is assumed above that brook trout might be comparable to short-day plants and should naturally spawn as the days decrease in length. These experiments suggest this fact may be true, although they do not demonstrate it conclusively. Likewise it is not definitely known from this series of experiments if it was necessary to add light to induce brook trout to spawn or if merely diminishing the daylight period would have been sufficient. It is also possible that a combination of the two methods might be necessary. In any case it seems evident that the sexual cycle of some fish, like that of mammals and of birds, can be manipulated by controlling the length of day. The main objective of the present experiments was to reproduce a yearly light cycle in a shorter period of time than it occurs in nature.

Rainbow trout, *Salmo gairdnerii*, in a separate series of experiments, were induced to spawn in December by increasing the length of day, but the data may not have been significant because of pronounced hybridization in the stock between races having different breeding times. Therefore, the results were not published. The experiments will be repeated in the future.

The practical value of inducing early spawning in fish should be well worth consideration as an aid to fish cultural work.

Conclusions

1. Brook trout, *Salvelinus fontinalis*, were induced to spawn in advance of the usual spawning period by controlling light conditions.

2. Albino brook trout were influenced by light in the same degree as normal fish.

Literature Cited

Bissonnette, T. H.
1930 Studies on the sexual cycle in birds. *Amer. Jour. Anat.*, 46: 447.
1932 Light and sexual cycle in birds. *Physiol. Zool.*, V: 92–123.
1935a Sexual photoperiodicity. *Collecting Net*, 10 (5).
1935b Relations of hair cycles in ferrets to changes in the anterior hypophysis and to light cycles. *Anat. Rev.*, 63: 159–167.
1935c Modification of mammalian sexual cycles. *Jour. Exp. Biol.*, 12: 315–320.

Bissonnette, T. H. and Csech, A. G.
1936 Fertile eggs from pheasants in January by "night-lighting." *Bird Banding*, 7: 168–169.

Hoover, Earl E.
1937 Experimental modification of the sexual cycle in trout by control of light. *Science*, 86: 425–426.

Marvin, C. F.
1905 Sunshine tables III latitude 40°–50° north. *U. S. Dept. Agriculture W. B.*, 805: 12–13.

Rowan, W.
1926 On photoperiodism, reproductive periodicity, and the annual migrations of birds and certain fishes. *Proc. Boston Soc. Nat. Hist.*, 38 (6): 147–189.
1930 Experiments on bird migration. *Proc. Nat. Acad. Sci.*, 16: 520–525.

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The American Atlantic Toadfishes of the Genus *Opsanus*[1]

By Leonard P. Schultz and Earl D. Reid

Goode and Bean (1879)[2] described two new subspecies of the common toadfish *Opsanus tau* (Linnaeus), which recent authors have generally considered to be synonyms of *O. tau*. However, we find from our recent study of the species referred to the genus *Opsanus* that *O. beta* Goode and Bean and *O. pardus* Goode and Bean are valid forms.

We refer to the genus *Opsanus* all those species with the following combination of characters: Body subcylindrical anteriorly, compressed posteriorly; head broad, strongly depressed; lower jaw projecting beyond upper; blunt conical teeth on jaws, vomer and palatines; no canines[3], dorsal rays III (very rarely II), 18 to 32; anal rays 15 to 27; opercle with two strong spines; subopercle with one stiff spine above which is a long thin flexible spine, not apparent without dissection; axil of pectoral with a foramen near the middle of the base of that fin; body scaleless; spines solid.

Opsanus hildebrandi Breder, since it lacks the axillary pore, is referred to the genus *Amphichthys* Swainson. Thus restricted, the genus *Opsanus* includes but four American species, which may be distinguished by means of the following key:

1a. Dorsal fin rays III, 23 to 26; anal 19 to 22; pectoral 18 to 22.

2a. Background color light, overlaid with brown spots as large as pupil or little larger on head, body, and fins, those on dorsal and anal arranged in more or less oblique rows; pectoral with brown spots on a light background instead of nearly round light spots or light cross bars; dorsal soft rays plus the rays in both pectorals minus the anal rays equals 45 to 48. ..... *Opsanus pardus* Goode and Bean

2b. Background color dark of more or less cross bands on body and fins instead of dark spots on a light background.

3a. Pectoral fin with definite cross bars, which are not composed of series of round or nearly round light spots, but the light areas are continuous across the fin; color on sides and belly of brownish to blackish reticulations, or finely mottled, especially on sides of belly; no round light spots present on sides of body; dorsal soft rays plus the rays in both pectorals minus the anal rays equals 41 to 45 (seldom 41). ..... *Opsanus tau* (Linnaeus)

3b. Pectoral fin with definite light cross bars made up of a series of distinct nearly round light spots; darkish background color of sides with small light spots; sides and belly without any trace of a reticulated color pattern; dorsal rays plus the rays in both pectorals minus the anal rays equals 38 to 42 ..... *Opsanus beta* Goode and Bean

1b. Dorsal fin rays III, 32, anal 27, pectoral 20 on both sides. Color uniform brown above paler below; base of caudal with one black ocellus on one side and three on the other, fins otherwise of uniform coloration like the body. ..... *Opsanus barbatus* Meek and Hildebrand

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[1] Published with the permission of the Secretary of the Smithsonian Institution.
[2] Proc. U. S. Nat. Mus., 2: 334–337.
[3] Canine teeth are here understood to refer to conical teeth which are much longer than other adjoining conical teeth.

The number of fin rays were counted in numerous specimens of *Opsanus*, and are recorded below.

TABLE 1. THE NUMBER OF FIN RAYS IN THREE SPECIES OF *Opsanus*

Species	Dorsal Fin Rays									Anal Fin Rays								Pectoral Fin Rays				
	Spines		Soft Rays																			
	II	III	23	24	25	26	—	32		19	20	21	22	23	—	27		18	19	20	21	22
O. tau	1	28	..	1	18	10	—	..		..	4	14	11	..	—	..		..	32	24	1	..
O. beta	..	47	1	6	39	1	—	..		1	1	19	24	2	—	..		60	34	..	..	..
O. pardus	..	8	..	..	1	6	—	..		..	1	4	3	..	—	..		1?	..	6	6	3
O. barbatus	..	1	..	..	..	..	—	1		..	..	..	..	..	—	1		..	..	2	..	..

We have examined the following specimens, represented by the catalogue numbers as recorded in the division of fishes of the United States National Museum:

Opsanus tau. MASSACHUSETTS: 16,550; 19,252; 43,076; 49,247; 49,632; 68,088; 68,089; 68,130; 70,161; 70,162; 70,349. RHODE ISLAND: 20,733; 25,753. CONNECTICUT: 13,939. NEW YORK: 48,976; 48,996; 49,023; 68,359. NEW JERSEY: 45,110. MARYLAND: 16,894; 45,460; 74,166; 74,875; 83,571; 83,575; 85,815; 89,808; 91,195; 91,196 to 91,199; 92,023; 92,384; 93,272; 93,757; 102,315. CHESAPEAKE BAY: 16,769; 38,948; 84,048; 91,204; 91,205. VIRGINIA: 3,441; 6,834; 10,111; 25,507; 30,250; 43,219; 67,729; 67,730; 91,200 to 91,203. NORTH CAROLINA: 51,850. SOUTH CAROLINA: 24,689; 25,360; 26,312; 59,057; 59,060; 59,076; 59,095. FLORIDA: 12,867 (St. Augustine); 18,034 (Mantanzas Inlet); 53,343 (Florida); 53,364 (New Smyrna); 91,397 (Fernandina Harbor).

The specimens in the National Museum indicate that *O. tau* does not occur as far south as the southern end of the east coast of Florida. In the vicinity of Cape Sable it is replaced by *O. beta*, which occurs along the Gulf Coast States and Mexico as far south as the Gulf of Campeche and in the West Indies. On the east coast of Florida we have two collections from Biscayne Bay, 67582 and 67587, which is the most northern record for *beta*. Around the southeastern coast of Florida, *beta* and *tau* appear to have intergraded to some extent both in color and in the index for the fin ray counts.

Opsanus beta. FLORIDA: (West Coast) 5,149 (cotype); 21,477 (lectotype); 23,541 (cotype); 30,170; 30,697; 30,811; 30,751; 30,951; 32,614; 34,717; 57,402; 65,371; 67,582; 67,587; 67,671; 68,438; 73,155 to 73,167; 73,169; 84,592; 87,837; 91,397; 91,447; 91,455; 92,216; 93,050; 101,079. MISSISSIPPI: 40,122. LOUISIANA: 82,095. TEXAS: 69,337; 73,584; 93,596. MEXICO: 746 (cotype); 803; 804; 39,274; 62,277. CUBA: 4,788; 37,546. WEST INDIES: 38,668.

Opsanus pardus. FLORIDA: 22,237 (2 types); 32,637; 73,172 to 73,174; 82,722.

Opsanus barbatus. PANAMA: Colon Reef: 81,009 (type).

DIVISION OF FISHES, UNITED STATES NATIONAL MUSEUM, WASHINGTON, D.C.

New or Unnamed Snakes from Costa Rica[1]

By Emmett Reid Dunn

In the preparation of a comprehensive account of the herpetological fauna of Lower Central America, I find it advisable to establish a number of new species and subspecies of snakes, and to record the following notes.

Leimadophis

Two forms of the genus *Leimadophis* Fitzinger (1843, Syst. Rept.: 25; type *Natrix almadensis* Wagler) occur in North America. Both are common snakes and both have been known for years, but one has never been named. The two differ as follows:

A. Belly white; Canal Zone to Ecuador ..... *epinephalus*
AA. Belly red with black blotches; Costa Rica to western Panamá.. *juvenalis*, subsp. nov.

Leimadophis taeniurus epinephalus (Cope)

Liophis epinephalus Cope, Proc. Acad. Nat. Sci. Phila., 14, 1862: 78 (Truando Riv., Colombia: type A. N. S. P. No. 3688).

Liophis reginae albiventris Jan, Arch. Zool. Anat. Phys., 2, 1863: 294 (Andes of Ecuador: type in Munich, not seen).

I have examined 191 specimens from eastern Panamá, where it occurs on both the Atlantic and Pacific sides. Ten localities in the Canal Zone are represented, including Barro Colorado Island, where I have taken it twice. It is known from four localities in Darien, including Caña, at 2000 feet elevation.

Leimadophis taeniurus ***juvenalis,*** subsp. nov.

Type.—A. N. S. P. No. 3678, collected by Van Patten.

Type Locality.—San José, Costa Rica.

I have examined 42 specimens of this snake, from the following localities in Costa Rica: El Copey, San Antonio de Belen, Barba, San José, La Palma, La Estrella, Cartago, Irazu, Rio Fusio, Navarro, Orosi, Juan Vinas, La Suiza, Cariblanco Carillo. Specimens at El Copey, La Estrella and Navarro were collected by myself. It flattens the whole body when annoyed.

Wettstein (1934, Sitzber. Akad. Wiss. Wien, 143: 341) records *Liophis (Rhadinaea) cobella* from Bebedero and from Irazu (2400 m.). *Liophis cobella* (and indeed the genus *Liophis*) is not otherwise known from North America, and Wettstein's scale counts and coloration fit the present form exactly. This snake has usually been called *epinephalus* (cf. Günther, 1893, Biol. Centrali-Americana: 107, pl. 37, fig. B), but *epinephalus* is, as might be expected, the form of the Canal Zone and Darien.

This form is named for my friend, the accomplished Director of the Museo Nacional de Costa Rica, Professor Juvenal Valerio.

Eight specimens from western Panamá (El Volcan, Boquete, Chiriqui) have less bold spotting on the belly, but agree with *juvenalis* rather than with *epinephalus*. There are no differences in scutellation between the two.

Conophis

Two forms of the genus *Conophis* Peters (1860, Monber. Akad. Wiss. Berlin: 519; type *vittatus*) occur in Costa Rica, one of which is new to science. The two differ as follows:

[1] Contributions from the Department of Biology, Haverford College, No. 34.

A. Upper labials immaculate; head light with three broad brown stripes; body light with brown stripes ..... *lineatus*
AA. Upper labials with black borders; head black with two white lines; body black with two white lines on each side ..... *nevermanni*, sp. nov.

Conophis lineatus (Duméril and Bibron)

Tomodon lineatum Duméril and Bibron (in part), Erp. Gén., 7, 1854: 936, pl. 73 (Mexico: type in Paris, not seen).

I have seen four Nicaraguan (Polvon) and ten Costa Rican (Barranca, Tivives, Esparta, San José, Cartago) specimens of this species. The range in these countries is almost exactly that of *Crotalus* and *Salvadora*.

Conophis ***nevermanni***, sp. nov.

TYPE.—A female in my own collection, obtained from Prof. Manuel Valerio.

TYPE LOCALITY.—Rio Poas de Aserri (a few miles south of San José).

DESCRIPTION.—Ventrals 182+2; caudals 70; dorsals 19–17, fourth dropping; scales smooth, pitless; nasal divided; oculars 1–2; temporals 2–2; upper labials 8, 4th and 5th in eye; lower labials 10, five in contact with anterior chin-shields; black, light below; a light line from snout continues on sixth scale row; a similar line on second scale row; upper labials boldly edged with black; length 470 mm., tail 73.

REMARKS.—A female in the Liceo de San José, without precise locality, has 179 ventrals; 9 lower labials; length 820 mm.; tail 70, incomplete.

This form is similar in scutellation and dentition to *C. lineatus*. The shape of the head is less acuminate, and it differs remarkably in color.

It would be interesting to compare the hemipenis of this snake with that of *C. lineatus*. The latter has the organ bifurcate; sulcus bifurcate; proximal 2/3 spinose; distal 1/3 calyculate; non-capitate.

The five snakes recorded from Bebedero, Costa Rica, by Wettstein (1934, Sitzber. Akad. Wiss. Wien, 143: 37) as *Coniophanes imperialis imperialis* (not otherwise known south of Honduras) differ from *imperialis* and resemble the present form in having black bordered supra-labials, four narrow yellowish-white lines, of which the upper two run along the canthus rostralis to the snout, and in length, reaching 840 mm. In a recent letter to Joseph Bailey, Wettstein says these specimens have 19 dorsals and 173–181 ventrals.

TRIMETOPON

Three forms of the genus *Trimetopon* Cope (1885, Proc. Amer. Philos. Soc., 22: 177; type *pliolepis*) occur in Costa Rica and one in Panamá. One of the Costa Rican forms is new to science. They may be distinguished as follows:

A. Two prefrontals
  B. Scales 17; ventrals 161; belly red; Costa Rica ..... *viquezi*, sp. nov.
  BB. Scales 15; ventrals 141–153; belly white; Canal Zone ..... *barbouri*
AA. One prefrontal
  B. Ventrals 132–154; head dark; upper Costa Rica ..... *gracile*
  BB. Ventrals 122; head mostly white; lower Costa Rica ..... *simile*

Trimetopon gracile (Günther)

Ablabes gracilis Günther, Ann. Mag. Nat. Hist., (4) 9, 1872: 18, pl. 3, fig. D (Cartago, Costa Rica; types B.M.N.H. Nos. 71-11-22, 19-20).

Trimetopon plioplepis Cope, Proc. Amer. Philos. Soc., 22, 1885: 177 (San José, Costa Rica; type A.M.N.H. No. 17302).

I have examined all the eight known specimens, from Cartago, San José, Turrialba, and La Palma, and have taken two at La Palma.

Trimetopon simile Dunn

Trimetopon simile Dunn, Occ. Pap. Bost. Soc. Nat. Hist., 5, 1930: 331 (Reventazon [probably = Siquirres], Costa Rica; type M.C.Z. No. 15263).

The type is still unique.

Trimetopon barbouri Dunn

Trimetopon barbouri Dunn, *l. c.*: 331 (Pedro Miguel, Canal Zone; type M.C.Z. No. 23877).

I have examined all the eight known specimens. The localities are: Ancon, Pedro Miguel, Madden Dam and Three Rivers Plantation on Gatun Lake.

Trimetopon ***viquezi,*** sp. nov.

TYPE.—A male, sent me by the Museo Nacional de Costa Rica, collected by Dr. C. Viquez.

TYPE LOCALITY.—Siquirres, Costa Rica.

DESCRIPTION.—Ventrals 161 + 2; caudals 33+; dorsals 17–17, smooth, pitless, a few slightly keeled at anus; nasal semidivided; oculars 1–2; temporals 1–1; upper labials 7, 3rd and 4th in eye; lower labials 8, four in contact with anterior chin-shields which are separated from the mental and are longer than the posterior; black above, each scale with a white streak at base except those of the vertebral and the fourth row (thus a mid-dorsal and a lateral dark line); throat white; belly and under side of tail red; a black streak from eye to suture of labials 4 and 5; a white streak from eye onto labials 6 and 7; a white streak from side of neck crosses labial 7; anterior labials spotted black and white; length 209 mm.; tail 31, incomplete.

REMARKS.—The markings of this form are quite similar to those of *barbouri.*

The characters of *Trimetopon* are much like those of *Rhadinaea,* but the maxillary dentition is weaker, without gap, the fangs less enlarged; the hemipenis is non-capitate; distal half calyculate; distal half of sulcus bifurcate; slightly bilobed in *viquezi,* single in *barbouri;* proximal half spinose; four enlarged basal hooks in *barbouri;* one large basal hook and four smaller in *viquezi.* My statement in 1930 (*l. c.*: 332) as to the similarity of the hemipenes of *Trimetopon, Leptocalamus,* and *Arrhyton* is entirely erroneous, and was derived from misleading statements in the literature. Both the hemipenes and the dentitions of the three genera are quite dissimilar, and they are not at all related.

The only other species of the genus, *Trimetopon posadasi* Slevin (1936, Proc. Calif. Acad. Sci., (4) 23: 79–81), from the volcanoes of Zunil and Atitlan, Guatemala, has two prefrontals, 17 scale rows, ventrals 138–149, caudals 80–93, a yellow collar, uniform dark brown with the two outer scale rows lighter. It differs from the southern forms in color and in caudal count. The southern forms have 58–69 caudals. I have examined one specimen from Zunil.

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Amphibians and Reptiles of the Jornada Experimental Range, New Mexico

By Elbert L. Little, Jr., and John G. Keller[1]

THIS report with respect to 27 species of amphibians and reptiles on the Jornada Experimental Range and 7 additional species in Mesilla Valley, Dona Ana County, N. Mex., is based on collections and notes made by the authors as a spare-time project during 1934 and 1935. Individuals of several species were studied by the junior author from 1931 to 1933 also. Fourteen of these species have not been reported previously from this county. Thus the Dona Ana County list is increased to 9 species of amphibians and 34 of reptiles, more than are known in any other county in New Mexico. The authors' collections of specimens of *Amyda emoryi* and *Rana tarahumarae* in Mesilla Valley, a part of Rio Grande Valley, probably are the first and second records, respectively, of these two species in this state.

The Jornada Experimental Range, where nearly all the authors' collections were made, has its headquarters 23 miles north of Las Cruces. It is an area of 302 square miles at the southern end of Jornada del Muerto, a plain which extends northward for more than 100 miles.

Most of the Jornada range is a plain in the Lower Sonoran life zone, varying in elevation from 4,000 to 4,600 feet and without permanent water, except wells and artificial tanks. San Andres Mountains and foothills along the eastern boundary rise in the Upper Sonoran life zone to 8,000 feet, and have a few permanent springs, of which Ropes Spring is best known.

The average annual rainfall is only 8.97 inches and the average annual temperature, 58.3°F., at the range headquarters. Winter nights are cold enough to cause hibernation, or inactivity, of cold-blooded vertebrates for a few months. In 1934, lizards and snakes were observed from March to November, but were most numerous during the summer. However, lizards of one common species (*Uta stansburiana stejnegeri*) were seen on warm days throughout the winter of 1934–35.

The vegetation of the Jornada Experimental Range has been discussed fully by R. S. Campbell (1929, 1931) and others. Both semidesert-shrub and grassland types of the Lower Sonoran zone occur on the plain. Shrub vegetation and small woodland areas of piñons and junipers occur in the foothills and mountains of the Upper Sonoran zone.

Early scattered collections and published records of the amphibians and reptiles of New Mexico were compiled by Van Denburgh (1924), and need not be cited here. He listed 14 species of amphibians and 74 species and subspecies of reptiles. The largest local list, one by Cockerell (1896), is of 27 species from Las Cruces and vicinity in Mesilla Valley of Rio Grande, Dona Ana County, in which county the Jornada range is also located. Eight

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of these are not represented in the authors' collection, namely, *Rana pipiens, Sceloporus magister, Diadophis regalis, Liopeltis vernalis, Elaphe laeta, Lampropeltis getulus splendida, Rhinocheilus lecontei,* and *Sistrurus catenatus edwardsii.*

Van Denburgh mentioned Cockerell's species with other Dona Ana County records. He added two species to the county list, *Holbrookia maculata approximans* and *H. texana,* from Parker's Well, located in Sec. 35, T. 21 S., R. 4 E., but long abandoned. The names of two other species listed by Van Denburgh from this county, *Cnemidophorus grahamii* and *Eumeces guttulatus,* have since been reduced to synonymy.

The authors' collections of 34 species, 27 on Jornada range and 7 in Mesilla Valley, add 14 species to the Dona Ana County list. Ten forms of snakes of the irrigated Rio Grande Valley, including those collected by Cockerell, could not be found on the Jornada plain.

Lizards are the commonest vertebrates of the plain part of the Jornada range, where most of the reptiles seem to be distributed without relation to either soils or vegetation. The few species common among the foothills and absent or rare on the plain are *Bufo punctatus, Crotaphytus collaris baileyi, Uta ornata ornata, Coluber taeniatus,* and *Crotalus molossus.*

Stomach contents of the specimens were examined, but because of the small numbers of specimens available and the fact that some stomachs were empty, no generalizations can be made with respect to the kind and percentage composition of food of the different species. The drought of 1934 undoubtedly made insects and other articles of food scarce. Probably most of the amphibians and reptiles on the Jornada range are negligible factors in range management. They probably are beneficial to a certain degree in eating various insects, especially harvester ants, which consume grass seeds. Perhaps the snakes aid also in killing small grass-destroying rodents, although none was found in the few stomachs examined. Without doubt these cold-blooded vertebrates play a role in determining the properly balanced state of nature, and should not be indiscriminately destroyed.

For their interest and co-operation in collecting specimens while in the field, credit is due members of the Jornada range personnel. Eugene T. Ares expressed his enthusiasm by bringing in specimens. For assistance in checking determinations, the authors are indepted to Drs. Edward H. Taylor, Doris M. Cochran, Walter P. Taylor, A. I. Ortenburger, and Clinton V. MacCoy.

A complete set of the authors' specimens has been deposited in the United States National Museum, and another set has been retained at the Jornada range. Duplicate sets of most of them have been sent also to Dr. Edward H. Taylor for the Taylor collection and to the University of Oklahoma Museum of Zoology.

The following two lists, with notes, summarize this study. The first list includes 27 species of the Jornada range; and the second, the 7 additional species represented by the authors' small Mesilla Valley collection. The name "Cockerell" after notes on a species name indicates that the species was listed also from Mesilla Valley by Cockerell (1896), and the name "Van Denburgh" signifies that Van Denburgh (1924) mentioned for the species other locality records from Dona Ana County than those of Cockerell.

SPECIES OF AMPHIBIANS AND REPTILES ON JORNADA EXPERIMENTAL RANGE

Ambystoma tigrinum (Green).—Larvae of various sizes were very common in an artificial pond at the range headquarters in June, 1931, and one of these transformed. An axolotl, length 285 mm., and four larvae, three of which later metamorphosed, were taken March 21, 1934, from the steel storage tank into which this pond drains. Adult salamanders have been collected infrequently at headquarters, and two were found in a gypsum sink. (Cockerell, Van Denburgh.)

The larvae collected in 1931 had eaten small mussels, crustaceans, spadefoot tadpoles (*Scaphiopus hammondii*), and a few insects. Specimens of these retained in the laboratory ate tadpoles (*S. hammondii*), small larval individuals of their own kind, and insects that were fed them. They would not eat small meat scraps, raw or cooked.

Scaphiopus hammondii Baird.—By far the most abundant amphibian of the semidesert plain here, although inconspicuous except during mating. Hundreds of individuals and clasping pairs were observed at the artificial pond and temporary pools around headquarters after summer rains in 1931 and 1932. Croaking started 15 to 30 minutes after the beginning of a rain and continued during the night and next day, so long as it was very cloudy. After prolonged rains, pairs were seen day and night for several days.

Adults were found also in August, 1931, and September, 1932, in newly excavated cellars at headquarters. During the excavation, evidences of the gelatinous coat or jelly layers which spadefoots secrete about themselves while buried over dry periods were observed.

In the extremely dry year of 1934 large numbers of spadefoots gathered at the temporary pools for mating after the three important summer rains, on May 23, July 24, and August 26. The croaking was rather loud; the number of croaks averaged 75 or 80 a minute. After the first rain, individuals were seen occasionally at night around headquarters and infrequently in early morning. Two were collected in the afternoon, as noted under *Bufo debilis*. All the stomachs examined were empty. During 1935, spadefoots congregated in a newly constructed storage tank at headquarters, and were thus less dependent upon rains.

Eggs collected in clusters on dead vegetation the morning of July 12, 1932, after the first heavy summer rain, developed into the tadpole stage in the laboratory within 36 or 48 hours, including the time estimated between laying and collecting. Tadpoles in the laboratory were noted to eat the algae on the sides of the tanks along with lettuce and other vegetable matter. They were extremely fond of insects, especially non-chitinous forms, and small crustaceans. Cannibalistic tendencies were observed in the laboratory and at Frog Pond. Tadpoles attached themselves to other individuals which they slowly absorbed through their small mouths until only outer skins were left.

Scaphiopus couchii Baird.—One specimen was collected in the new headquarters storage tank in 1935. Its full stomach contained about 10 arachnids and 1 small centipede.

Bufo cognatus Say.—Two were collected at night around headquarters buildings. The stomach of one contained 13 beetles (including 4 individuals

of *Eleodes* sp. and 1 of *Elater* sp.), ants, flies, moths, 4 seeds, and 11 nematodes.

Bufo debilis Girard.—Four of these small green toads were taken in 1934 and one in 1935. Two, with two members of the species *Scaphiopus hammondii,* were found on bare adobe loam soil one afternoon while poisonous plants were being eradicated with a kerosene burner, which toads may have been driven out of holes in the ground by the heat. Another was caught at headquarters at night. The fourth, located in a toad chorus (*Scaphiopus hammondii*) by its longer, shrill bleat, was collected at a temporary pool near headquarters the night following an afternoon rain. The 1935 specimen was found in a tobosa flat after a rain, and had eaten insects.

Bufo punctatus Baird and Girard.—Many newly metamorphosed individuals, averaging 15 mm. in length, were found in July, 1931, at Ropes Springs and around other springs in San Andres Mountains. Tadpoles were common during June and July, 1931, and were collected at Ash Spring on July 4, 1934. Food of the metamorphosed specimens consisted almost entirely of small ants.

Adults were not found until May and June, 1935, when numerous individuals gathered for mating in a spring and in a new concrete storage tank at Ropes Spring. Many tadpoles hatched here. The stomachs of adults were mostly empty; a few contained ants, beetles, and insect fragments.

Crotaphytus collaris baileyi (Stejneger).—Four individuals were collected in the rocky foothills and one on the plain. Stomach contents included one horned toad (*Phrynosoma modestum*), cicadas, one grasshopper, and insect fragments. (Cockerell, Van Denburgh.)

Crotaphytus wislizenii Baird and Girard.—Common, especially in sandhills of the plain. Stomachs of all six specimens contained remains of smaller lizards, mainly of the genus *Cnemidophorus* and one of *Sceloporus c. consobrinus*. A few insects and a tapeworm were present in one stomach. (Cockerell, Van Denburgh.)

Holbrookia maculata approximans (Baird).—Very common on the plain, and exhibiting wide variation in color. Insects, chiefly ants and beetles, were found in the stomachs. (Van Denburgh.)

Uta ornata ornata (Baird and Girard).—A few of these lizards were found in the foothills. Stomachs contained several ants, a beetle, and remains of other insects.

Uta stansburiana stejnegeri Schmidt.—Probably the commonest lizard on the plain. Individuals showed considerable variation in color. They had eaten insects, mainly ants and a few beetles. (Cockerell.)

Sceloporus consobrinus consobrinus (Baird and Girard).—Common on the plain. Ants, beetles, and other insects were found in the stomachs.

Phrynosoma cornutum (Harlan).—Fairly common on the plain. The food of these horned toads consisted almost entirely of ants and a few other insects. However, ants killed one of these horned toads caged over an ant hill. From one hundred to several hundred ants were found in full stomachs, also a few weevils and other beetles. The stomachs were heavily infested with as many as 100 small nematodes. (Cockerell, Van Denburgh.)

Phrynosoma modestum Girard.—Found on the plain, except on sandy

soils, and in foothills. Horned toads of this species are less common than those of *P. cornutum* on the Jornada range. Stomach contents included nematodes, many ants, and a few beetles and other insects. (Cockerell.)

Cnemidophorus perplexus Baird and Girard.—Common on the plain. The stomachs contained insect fragments, termites, and ants. (Cockerell.)

Cnemidophorus tessellatus tessellatus (Say).—Common, especially in mesquite sandhills. Caterpillars, termites, beetles, and remains of other insects were found in the stomachs. Van Denburgh mentioned that members of this species had been found 15 miles north of Las Cruces, probably near the Jornada range. (Cockerell).

Eumeces obsoletus (Baird and Girard).—Three specimens were collected, two from the foothills and one on the plain. The stomach contents included a spider, fragments of a beetle, and remains of small insects. The name *Eumeces guttulatus* (Hallowell), which was formerly applied to the young of *E. obsoletus,* was based on specimens from the type locality, Fort Fillmore in Dona Ana County. (Cockerell, Van Denburgh.)

Heterodon nasicus Baird and Girard.—Four specimens were collected on the plain. One had eaten a spadefoot (*S. hammondii*). (Cockerell.)

Coluber flagellum subsp.—The Jornada specimens are intergrades between the subspecies *C. flagellum flavigularis* (Hallowell) and *C. flagellum frenatum* (Stejneger). Found on the plain. One, 147 cm. long, was the longest snake collected. Three had eaten lizards (probably *Uta stansburiana stejnegeri*). Cockerell's (1896) specimen cited as *Bascanion testaceum* is now classed as *C. flagellum flavigularis.*

Coluber taeniatus subsp.—Two specimens intermediate between *C. t. taeniatus* (Hallowell) and *C. t. girardi* Stejneger and Barbour were obtained in the foothills.

Pituophis sayi affinis (Hallowell).—Common on the plain. One 51 cm. long ate three lizards, each of a different species, within a few hours after it was placed in a jar with them. (Cockerell.)

Thamnophis sirtalis parietalis (Say).—One specimen was obtained near water at Ropes Spring. (Cockerell.)

Tantilla nigriceps Kennicott.— Two individuals were collected at headquarters. (Cockerell.)

Crotalus atrox atrox (Baird and Girard).—Several diamondback rattlesnakes have been killed on slopes near Dona Ana Mountains, and one was collected on the plain.

Crotalus confluentus confluentus (Say).—Prairie rattlesnakes are probably the commonest snakes on the plain of the Jornada Experimental Range. Specimens were collected from March 29 to November 1, 1934.

Crotalus molossus Baird and Girard.—Two specimens were taken under trees in a draw below Ropes Spring in the foothills.

Terrapene ornata (Agassiz).—Common on the plain. Stomachs contained a few ants and beetles, and a few had one or two nematodes. Found also in Mesilla Valley. (Cockerell.)

Additional Species from Mesilla Valley

Bufo woodhousii Girard.—The common toad of Mesilla Valley, where

several were collected along irrigation ditches and near houses. The food was principally beetles, together with a few ants and other insects. (Cockerell.)

Rana tarahumarae Boulenger.—This species of frogs, first described from Chihuahua, Mexico, has recently been recorded from Arizona by Berry Campbell (1931) and from New Mexico by Linsdale (1933). The authors' collection probably is the fourth scientific record of this species, of which only 10 specimens have been reported, and the second record for New Mexico. One specimen 70 mm. long was caught on August 11, 1934, and 9 smaller ones averaging 50 mm. in length were taken on November 4, 1934, all in small pools bordered by willows and cottonwoods along Rio Grande near Mesilla Dam. Stomach contents showed that the food included various insects (beetles, flies, moths, and the like), spiders, snails, and minnows.

Rana catesbeiana Shaw.—Bullfrogs, which were not listed by Van Denburgh (1924), have been introduced in a few localities in New Mexico, including irrigation ditches in Rio Grande Valley near Las Cruces. Although specimens were not obtained, they were seen and heard.

Leptotyphlops dulcis (Baird and Girard).—One specimen was collected in Mesilla Valley. (Cockerell.)

Arizona elegans occidentalis Blanchard.—The authors obtained one specimen at the edge of Mesilla Valley near Las Cruces. (Cockerell.)

Lampropeltis triangulum gentilis (Baird and Girard).—One specimen was found in Mesilla Valley. (Cockerell.)

Thamnophis marcianus (Baird and Girard).—Although Cockerell did not list this species, three specimens were collected near Mesilla Dam, two in a marshy pond, and one along Rio Grande.

Amyda emoryi (Agassiz).—Soft-shell turtles were not mentioned by Van Denburgh, but Ellis and Henderson (1913) cited *Amyda spinifera* from New Mexico. Apparently this forms the first New Mexico record of *A. emoryi*, the soft-shell turtle of the Rio Grande. Five specimens were obtained on November 4, 1934, in Rio Grande near Mesilla Dam, the largest of which had a carapace 20 cm. long. Another, seen May 27, 1934, was about 30 cm. long. Numerous fragments of egg shells were found in the sand nearby. Living individuals of this species were on sale at the market in Ciudad Juarez, Chihuahua, Mexico, opposite El Paso. It was said that these were from a lake in Chihuahua.

Hard-shell water turtles are present also in a pond near Mesilla Dam, according to fishermen; but attempts to get a specimen were unsuccessful. These may belong to the species *Chrysemys bellii bellii* (Gray) which has been recorded from Rio Grande in New Mexico. A live individual was found at the Juarez market also.

Literature Cited

Campbell, Berry
1931 *Rana tarahumarae*, a frog new to the United States. Copeia, 1931 (4): 164.

Campbell, R. S.
1929 Vegetative succession in the Prosopis sand dunes of southern New Mexico. *Ecology*, 10: 392–398.
1931 Plant succession and grazing capacity on clay soils in southern New Mexico. *Jour. Agr. Res.*, 43: 1027–1051.

COCKERELL, T. D. A.
1896 Reptiles and batrachians of Mesilla Valley, N. Mex. *Amer. Nat.*, 30: 325–327.
ELLIS, MAX M., and HENDERSON, JUNIUS
1913 The Amphibia and Reptilia of Colorado, Part I. *Univ. Colo. Studies*, 10 (2): 39–129, pl. I–VIII.
LINSDALE, JEAN M.
1933 A specimen of *Rana tarahumarae* from New Mexico. COPEIA, 1933 (4): 222.
VAN DENBURGH, JOHN
1924 Notes on the herpetology of New Mexico, with a list of species known from that state. *Proc. Calif. Acad. Sci.*, 4th ser., 13 (12): 189–250.

TUCSON, ARIZONA.

Soft-Shelled Turtles in the Colorado River Basin

By JEAN M. LINSDALE and J. LINSLEY GRESSITT

SOFT-SHELLED turtles were reported from the drainage of the Colorado River in 1924 by Schmidt (COPEIA, 1924: 64) on the basis of a specimen of *Trionyx emoryi* presented to the Field Museum of Natural History from Phoenix, Arizona. The collector of the specimen knew of the turtles as plentiful in rivers and irrigation ditches in that part of central Arizona and believed them to be native. Schmidt thought it probable that the animals had been introduced near Phoenix.

A collector for the Museum of Vertebrate Zoology, C. C. Lamb, on June 15, 1928, saw three turtles in the Colorado River delta, seven miles east of Cerro Prieto, Lower California. He did not obtain specimens, but did arrange for sending some to the Museum. Two individuals were sent alive in early December 1928, by Mr. C. S. Thompson who got them in the Imperial Irrigation District, one fifteen miles south of the International Boundary in the Alamo Canal, the other one mile north of Black Butte in Salfatana Canal. On account of lack of specimens of eastern turtles and because of a rumor that the turtles had been released by Chinese farmers in Lower California, no attempt was made then to identify these specimens.

Another soft-shelled turtle was caught on a hook and line on April 11, 1936, by E. R. Hall in the Colorado River, six miles north of the California line, in Clark County, Nevada. This one was brought to the Museum alive and photographed (see figs. 1–3). Cowles and Bogert (Herpetologica, 1, 1936: 42) reported this animal as captured at Boulder Dam and observed just north of Black Canyon, Clark County, Nevada, and at Pierce Ferry, in Mohave County, Arizona, near the Nevada line. They also mention a specimen obtained in 1929 at California Lakes, Imperial County, California.

After a specimen of *Trionyx emoryi* taken by A. E. Borell on November 9, 1936, in the Rio Grande, near Boquillas, Brewster County, Texas, reached the Museum we undertook to establish the identity of the Colorado River animals. Characters of all four individuals agree essentially with those assigned to the species *emoryi* in the original description of it by Agassiz (Contr. Nat. Hist. U. S., 1, 1857: 407). Prominent items in the original description are the following: the front margin of the carapace has a single row of small tubercles; hind half of shield wider than front half and its upper surface

dotted with small whitish tubercles arranged in longitudinal rows along the posterior part of the vertebral column, and diverging somewhat upon the sides, upon a nearly uniform grayish ground, without ocelli or distinct

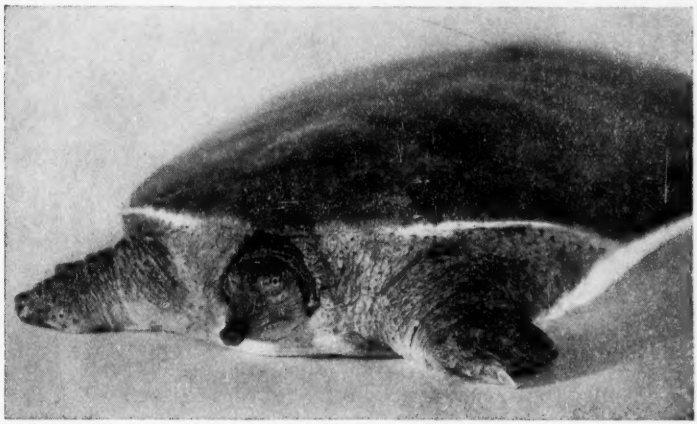


Fig. 1. Live example of *Trionyx emoryi* from six miles north of California line, in Clark County, Nevada. Mus. Vert. Zool. No. 19304, captured on April 11, 1936. The row of tubercles on the front margin of the carapace, the black dots on the front legs, and the head markings are among the specific characters shown in this photograph.

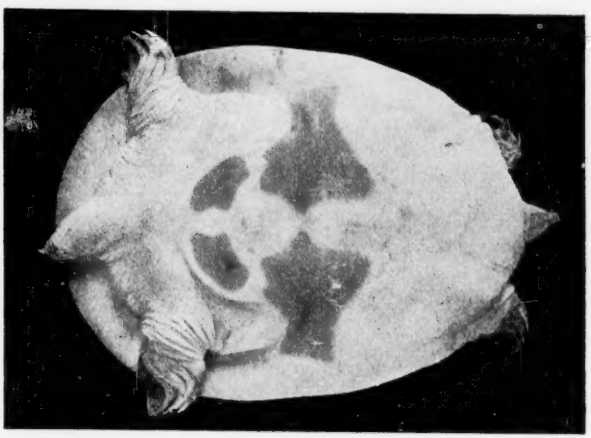


Fig. 2. Ventral view of soft-shelled turtle from Clark County, Nevada, same individual as shown in figure 1.

blotches. The pale rim of the hind margin is broad and in young specimens is separated by a distinct black line. The whole lower surface is white, except for dark lines along the inner surfaces of the fingers. The upper surfaces of the legs and the upper parts of the neck and of the head are marked with

small black dots. A straight black line extends in front of the eyes across the space which separates them, and forms a triangle with two similar lines extending from each eye to the tip of the proboscis.

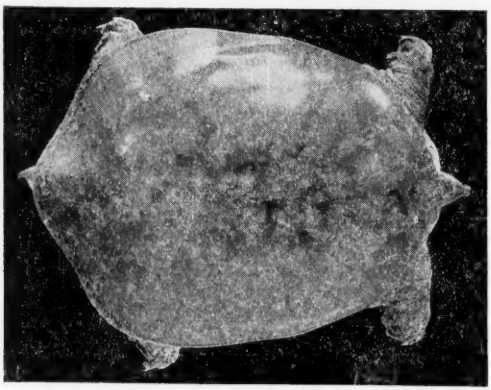


Fig. 3. Dorsal view of soft-shelled turtle from Clark County, Nevada, same individual as shown in figure 1.

Additional color notes made upon the specimen from Clark County, Nevada, at the time of its arrival in the flesh are as follows. Head Isabella color above, pinkish around eyes and snout; lips pinkish brown to greenish brown, regularly spotted with black; disk mottled, in a clouded run-together water-color fashion, with Isabella color, light brownish olive and dark brownish buff; sutures of carapace pinkish; a submarginal black line along sides, becoming an irregular dotted line posteriorly where it is about one centimeter from margin, anteriorly incomplete and represented by only a few irregular dots; ventral surface white to pinkish-white, the plastral plates showing through as whitish gray-green; undersides of membranous expansions of legs mottled blackish and greenish.

Dimensions (in millimeters) of the four specimens in the Museum of Vertebrate Zoology, mentioned above, are as follows.

No., Mus. Vert. Zool.	Locality	Length carapace	Width carapace	Length plastron
11192	Lower California	370	285	268
11193	Lower California	333	250	245
19304	Nevada	323	234	231
22329	Texas	255	171	184

These specimens have seven pairs of costal plates, thus belonging definitely with the American species rather than the Asiatic ones which normally have eight according to M. A. Smith (Fauna of British India, Reptilia and Amphibia, 1, 1931: 165). That author has given the reason (Bull. Raffles Mus. Singapore (3), 1930: 2) for using *Trionyx* rather than *Amyda* as the generic name for the soft-shelled turtles of America. Geoffroy

in establishing the genus *Trionyx* (Ann. Mus. Hist. Nat. Paris, 14, 1809) clearly intended (p. 20) *Trionyx Aegyptiacus* [=*T. triunguis*] to be the type.

We conclude from the facts assembled here that soft-shelled turtles are established in the Colorado River from near its mouth in Lower California at least to the lower part of the Grand Canyon in Arizona and to the vicinity of Phoenix, Arizona, on the Gila River, and that they belong to the same species as occurs in the Rio Grande in Texas, which is now properly called *Trionyx emoryi* (Agassiz). Whether this species is native in the Colorado River or was transplanted there in recent years, we have been unable to determine.

MUSEUM OF VERTEBRATE ZOOLOGY, UNIVERSITY OF CALIFORNIA, BERKELEY, CALIFORNIA.

The Spadefoot Toad Under Drought Conditions[1]

By GEORGE A. MOORE

SOME observations were made in the spring of 1936 on the activities of *Scaphiopus bombifrons* Cope in a certain temporary pool situated on the farm of the Oklahoma Agricultural and Mechanical College Experiment Station at Stillwater. Available literature reveals no information on the reactions of the spadefoot toad to drought conditions. Mr. and Mrs. A. H. Trowbridge [2] of Norman, Oklahoma, have recently studied the early development and life history of this species in the laboratory.

On May 8 heavy showers (totaling 2.12 in.) continued through the day and by 8:15 P.M. *Scaphiopus* was abundant in terrace ditches on the college farm. At first they were easily collected, but later in the night they would disappear on our approach. Several clasping pairs were obtained. One of these was placed in an aquarium about 2 A.M., and by morning eggs had been deposited. On the night of May 8 our entire time was spent working at the terrace ditches and a nearby roadside pool was overlooked. The terrace ditches were later drained by farm employees. The roadside pool had a maximum depth of about one foot. Comparisons of tadpoles in this pool with those developed from the above mentioned eggs, indicate that they were of the same age.

A thunder shower (totaling .87 in.) on May 22 again brought the toads out in great numbers, but this time they were much more numerous in the roadside pool than in the terrace ditches. Specimens were mostly males, some of which swam about silently, while others floated, singing loudly. A swimmer would occasionally come close to, or actually collide with, a singer, which seemed oblivious to the presence of other toads. The singers always attempted

[1] Contribution from the Zoological Laboratory of the Oklahoma Agricultural and Mechanical College.
[2] Trowbridge, A. H., and Trowbridge, Minnie Stambaugh. Notes on the cleavage rate of *Scaphiopus bombifrons* Cope. With additional remarks on certain aspects of its life history. Amer. Nat., 71 (736), 1937: 460–480.

to clasp the swimmers, and a struggle ensued ending in the dislodgement of the clasping individual, which then would resume his song. Excited cries, of an entirely different timbre, attend these matings. A female behaved in an entirely different manner. When clasped she tried to throw off the male and, not succeeding, hopped out of the water and proceeded across the road with the male on her back. At this point the pair was taken. The male maintained his hold until placed in the aquarium where he released it. He was placed in contact with the female and again clasped. Dissection later proved this female was spent.

On May 27 tadpoles were numerous in the pool, and in many the hind legs were visible. A high wind blew all day June 1, and the water in the pool became so low that the tadpoles were floundering in mud and slime. Their hind legs were well developed at this time. June 3, at 3 P.M., there was no water left. The tadpoles were closely packed together, their tails in the moist earth, their backs encrusted with dry soil, and their bodies inclined at about 45 degrees. A queer popping sound was produced as they opened and closed their mouths in breathing. On June 4 a count revealed that about 25 per cent were dead; when some of the living ones were placed in water, they became very active. There was so little moisture that a farmer had driven a wagon through the place, and his tires made a depression less than 1 in. in depth. June 3 was a sunny day, with a maximum temperature of 82 degrees. June 4, with a maximum temperature of 84° F., was bright until shortly after noon, when clouds began to gather. Rains totaling 1.62 in. fell during the late afternoon and evening, and the next day the tadpoles were so numerous that their losses seemed insignificant. How long they could withstand such unfavorable conditions is uncertain, but they were exposed to the direct sunlight of 1½ days and about 75 per cent survived. Tadpoles kept dry in the laboratory survived until June 6. Lack of food and toxic conditions resulting from the proximity of their dead fellows would no doubt account for the ultimate death of the strongest.

Observations on the drought resistance of adults were limited to one pair (female gravid) which was placed in a barrel partly filled with soil and half buried in the ground. The fate of this pair is not yet determined. The female still retains her eggs (visible through the abdominal wall) on the date of this writing, December 22, when the pair was examined. These individuals lived through the month of August in about 12 in. of dry soil. August, at Stillwater, was extremely hot and dry with the temperature reaching 115° F.

During the course of these observations the eggs of *Scaphiopus bombifrons* were taken on April 28, May 8, and May 22. The Trowbridges found that this species had but one breeding congress a year at Norman, but in 1936 at Stillwater there were 3, the principal one on May 8, which was the date of the congress at Norman. A comparison of the climatological data of the two localities, for April and May, explains this difference. It is hoped that observations on the life history of this interesting species may be continued in future years.

OKLAHOMA AGRICULTURAL AND MECHANICAL COLLEGE, STILLWATER, OKLAHOMA.

A Note on the Metamorphosis of the Tadpoles of *Bufo cognatus* [1]

By Arthur N. Bragg

RELATIVELY little is known concerning the life-history of the Great Plains toad, *Bufo cognatus* Say. Young and intermediate sized tadpoles have been described (Bragg, 1936) and the breeding habits and eggs are also known (Bragg, 1937). Nothing definite has been published concerning the metamorphosis of this toad, although Strecker (1910) says, ". . . the metamorphosis of the tadpole is said to take less than two weeks." It is not clear whether this statement means to imply that the larval stages may pass completely within this short time or that the transformation, once initiated, takes less than two weeks for completion. It is the purpose of this note to report a few observations on the metamorphosis of tadpoles of *B. cognatus* obtained from eggs laid in the laboratory during the night of May 8, 1936, as discussed in an earlier paper (Bragg, 1937).

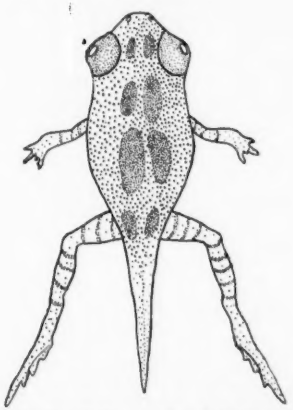


Fig. 1. Metamorphosing *Bufo cognatus* tadpole, dorsal view (X 3).

During late May and early June, the larvae in question grew rapidly on a diet of algae and flake fish-food. Raw liver was offered them from time to time but they were not observed to ingest it. However, whenever one of the tadpoles died and started to disintegrate it was immediately devoured by the others. Sections of well developed larvae showed algal remains in the digestive tract.

On June 16, five of thirteen tadpoles confined in a single dish had the hind legs well developed, the fore limbs had broken through, and the mouth parts were changing. The tail was not visibly reduced in size and was still used for swimming. All of the remaining tadpoles had well developed hind legs but not fore legs.

The color pattern on the more advanced larvae was distinctive. Dorsally,

[1] Contributions from the Zoological Laboratory of the University of Oklahoma, No. 183.

the skin presented a dark-brown background, in some individuals lighter than in others. Two rows of large black pigment spots extended down the back. These spots were arranged in pairs and were very prominent. One pair, as shown in the figure, was much larger than the others. The dorsal surface also presented a pebbly appearance due to very fine, low, wart-like protuberances uniformly distributed over it. Ventrally, the surface was of a uniform dirty white color and the pebbly appearance was much less marked. Both pectoral and pelvic limbs were ringed with brownish black bands.

The measurements of the transforming tadpoles were as follows:

	largest	average (of 13)
Total length	28 mm.	21 mm.
Head–body length	12 mm.	11 mm.
Tail length	16 mm.	10 mm.

This is slightly smaller than the other tadpoles in the same dish which had hind legs and were developing the dorsal spots but whose fore legs had not appeared. The largest of these measured 29 mm. in total length (head–body 12 + tail 17).

At this time, tadpoles confined in another dish showed no signs of metamorphosis although of the same age and of approximately the same size as the others. In mid-July, most of these began their transformation and one of them resorbed the tail within three days of the time when it was first noticed to have fore limbs. Air temperatures were very high during this period (over 100° F. at noon on most days) and this may have hastened the process since all of the animals were kept at laboratory temperatures.

From the observations reported above the following facts are evident:
(1) tadpoles of *Bufo cognatus* may start metamorphosis within one and one half months of fertilization;
(2) some, probably through a reaction to environmental factors, may retain larval characteristics two and one half months; and
(3) once transformation is started, it is completed rapidly under the laboratory conditions maintained during this study.

A more detailed study of the metamorphosis of this toad is planned when material becomes available.

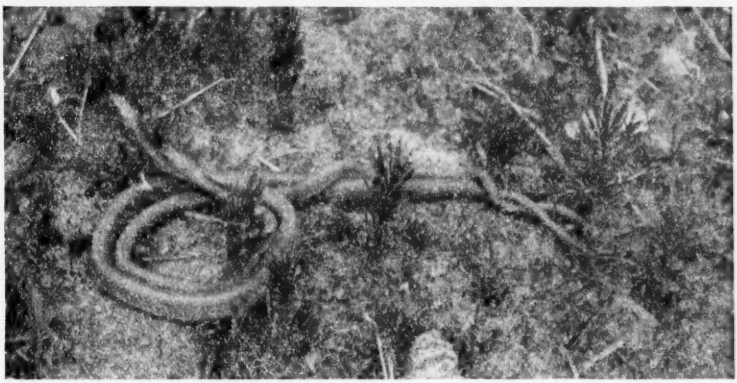
Literature Cited

Bragg, Arthur N.
1936 Notes on the breeding habits and larvae of *Bufo cognatus* with a description of the tadpole. Copeia, 1936: 14–20.
1937 Observations on *Bufo cognatus* with special reference to breeding habits and eggs. *Amer. Midl. Nat.*, 18: 273–284.
Strecker, John K.
1910 Notes on the fauna of a portion of the canyon region of northwestern Texas. *Baylor Univ. Bull.*, 13: 19–21.

University of Oklahoma, Norman, Oklahoma.

Herpetological Notes

COPULATION IN THE WESTERN BLUE RACER.[1]—The copulation of the western blue racer, *Coluber constrictor mormon,* as illustrated in the accompanying photograph, was observed about mid-day on June 10, 1927, at Moab, Grand Co., Utah.



The snakes were encountered in a damp, grassy meadow near the banks of the Colorado River. Since they were not observed until we had approached to within 5 to 10 feet, it is assumed that they were relatively quiet until disturbed. They evidenced great perturbation when they became aware of us, however, and made violent and seemingly uncoordinated movements in their attempt to escape, although they remained in copulation during all their efforts to get away. When first observed the snakes were twined one about the other, but the number of coils increased as they moved off. Their path was tortuous and their motion spiral in nature, due to their independent efforts in attempting to travel under this handicap. No evident attempt was made on the part of the snakes to separate during the quarter hour or so of observation and disturbance. —WALTER P. COTTAM, *University of Utah, Salt Lake City, Utah.*

THE ST. HELENA FROG, *RANA GRAYI* SMITH.—I was in St. Helena for six weeks in 1937, from the end of January until the middle of March. Frogs seemed to inhabit all the cool damp valleys where small watercourses trickled, and were particularly fond of hiding in the shade of the big leaves of the slave yams. Their voices are particularly well described by Dr. Barbour in his article in COPEIA (No. 4, 1934; 183).

I never saw or heard a frog below the altitude of about 800 feet, but found tadpoles on Mount Diana at a height of about 2200 feet. They were in shallow cups full of rain water, about the size and shape of soup plates, in flat stones.

I only once saw a frog larger than about 35 mm. This one, which I saw floating in a deep underground cistern in the ruined fort on High Peak, was as big as a full sized edible frog. It was some 20 feet below me and I was unable to obtain it. In the dim light the frog looked a yellowish color and had a pronounced light median stripe down its back.

I made minute enquiries to discover when and by whom frogs were first introduced to St. Helena. Mr. Moss, the present post-master, told me that he remembered vividly, as a boy, his aunt, Miss Phoebe Moss, bringing back from Cape Town or Durban, in 1885, a glass jar full of live frogs which she liberated at the Briars where the family lived. This is the house where Napoleon lived while Longwood was being prepared for him. The Briars stands in the valley above Jamestown, at an altitude of about 1000 feet.—PHILIP GOSSE, *Steyning, England.*

[1] Contribution from the Department of Zoology, University of Utah.

AMPHIBIANS OF GASPÉ COUNTY, QUEBEC.—During the period from June 14 to August 30, 1936, in making a zoological survey of the Forillon, the tiny finger-like tip of the Gaspé Peninsula which projects into the Gulf of St. Lawrence, I collected specimens of five species of Amphibia. Two of these, as far as I know, have not been reported thus far north (Lat. 48° 50′).

Triturus viridescens viridescens Rafinesque.—Not found on the Forillon, which lacks permanent ponds, but abundant at Third Lake about 12 miles west of Gaspé village.

Ambystoma maculatum Shaw.—On July 1, I found many egg-masses in a shallow pool about 80 feet long and 12 feet wide at an elevation of 700 feet above sea-level in the highlands a mile west of Grande Grève. The pool lies in dense forest, chiefly of spruce and balsam, interspersed with mountain maple, white birch, and mountain ash. A few bushes of willow and service berry struggle toward the narrow strip of sky above. Only at mid-day for a period of two hours does direct sunlight reach the water. By August 20 all water had evaporated or seeped away, thus destroying all larvae before metamorphosis. Larvae hatched in an aquarium on July 4 were reared until their identity could be determined.

Mr. Charles Lindsay, Superintendent of the Provincial Fish Hatchery at Gaspé, showed me an adult spotted salamander taken from the interior of the peninsula about 16 miles west of Gaspé town. Stejneger and Barbour, in their *Check List of North American Amphibians and Reptiles,* give the range of this species as "Nova Scotia west to Wisconsin, southward to Georgia and Texas." We now see that the range extends northward to the southern shore of the St. Lawrence River at its mouth.

No examples of *A. jeffersonianum* were seen, nor could I learn that they had been found in this region.

Plethodon cinereus (Green).—Common under logs and in decayed stumps in or near the forest, even in pure stands of spruce. Both color phases occur.

Stejneger and Barbour set the northern limit of the range as "Cape Breton Island west to Fort William, Ontario." The known domain of this species is also extended one or two degrees northward.

Eurycea bislineata was not found, although it has been recorded from Quebec and New Brunswick according to Stejneger and Barbour.

Bufo americanus Holbrook.—Rare on the Forillon. I found no adults, but a few evidently lived in the vicinity of Grande Grève, for on June 20 two small pools at the edge of a swamp back of the village contained newly-hatched tadpoles in numbers, indicating that a large string of ova had been deposited in each pool. The water disappeared long before metamorphosis could occur. Many, however, transformed to toads in my aquaria.

From Cap aux Os about five miles west of the Forillon several adults were obtained during the summer.

Rana septentrionalis Baird.—Common at Third Lake where several were taken in shallow water at the edge of a sandy beach August 8. Not recorded from the Forillon.

Rana sylvatica LeConte.—Adults were collected during the summer in various moist situations on the Forillon. Newly-metamorphosed frogs were numerous in grass along the margins of a swamp back of St. George's Cove August 18. Others metamorphosed at Cap aux Os on July 27–28 and at Little Gaspé, a half mile west of the Forillon, exactly a month later, August 26–27. About 100 half-grown tadpoles were present on August 10 in the cool, half-dry woodland pool noted above under *Ambystoma maculatum,* but undoubtedly died before August 20 when all water had disappeared.

The only reptiles seen were about 8 garter snakes (*Thamnophis sirtalis sirtalis*), of which 5 were preserved.—STANLEY C. BALL, *Peabody Museum of Natural History, Yale University, New Haven, Connecticut.*

A GOPHER TURTLE OF UNUSUAL COLORATION.—A single female specimen of the southeastern gopher turtle, *Gopherus polyphemus,* with a most unusual coloration, was collected near Orlando, Florida, by Mr. Sam MacDonald. The specimen was called to our attention by Mr. Charles Mosier of Miami and later was preserved by him. Observations are from the living animal. The specimen measured 215 mm. in length of carapace. The ground color of the carapace, using Ridgway's *Color Standards,* was seen to vary from "olive-brown" to "sepia." Every scute showed conspicuous but irregular

blotches of a lighter "straw" color near to Ridgway's "orange-yellow" but deeper and more soiled. The head and the neck and the lower portions of the legs were "grayish-olive" to "drab" (Ridgway). The skin of the upper legs and the skin next to the body was "pale-olive-buff" to dirty white. Eyes were normally dark.

The unusual coloration of this specimen is conspicuous when compared to the majority of the specimens of this area, which, of course, are uniformly dark brown to blackish. Ridges or "growth rings" were prominent on the scutes of the carapace. No indications of injury by fire were evident. The light-colored areas were normal in structure.—E. MORTON MILLER, *Department of Zoology, University of Miami, Coral Gables, Florida.*

SEGREGATED HIBERNATION OF *STERNOTHERUS ODORATUS* (LATREILLE).—On March 28, 1927, we found a large colony of hibernating *Sternotherus odoratus* in the drained bed of a canal north of Buckeye Lake, Licking County, Ohio. The canal had been partially drained during the winter, and to complete the drainage, a steam shovel had cut a narrow ditch along each inner bank of the canal. During the ditching operations the shovel uncovered from the bed of the canal a colony of turtles that had been segregated in an area of approximately 45 feet in length by 6 feet in width. We estimated a total of 450 turtles in this small area. Only the one species was found in the aggregation.

Almost all the turtles were dead, except perhaps 6 living individuals which were in the shallow water of the newly-created ditches. Apparently the removal of the water from the hibernating turtles, and exposure to a minimum temperature of approximately 15° F., had been sufficient to kill these animals. In the remaining half-mile of canal which we investigated, no turtles of this species were found.

Because of disturbed conditions, it was impossible to determine the exact depth in which the aggregation had been hibernating, though it appeared that they had been from a few inches to a foot beneath the surface of the soft, mucky bottom. We could detect no difference between the ecology of the hibernation site and dozens of similar situations in the half-mile length of canal. The canal, before the dredging activities, had been abandoned for years, though it always carried a good supply of water at all seasons of the year and contained an abundance of rooted aquatic vegetation. There was a slight flow of water, possibly sufficient to prevent the ponded waters from freezing solid. —EDWARD S. THOMAS, *Ohio State Museum, Columbus, Ohio,* and MILTON B. TRAUTMAN, *Museum of Zoology, Ann Arbor, Michigan.*

A CORRECTION IN THE RANGE OF *POTAMOPHIS STRIATULUS*.—An error regarding the range of the brown snake, *Potamophis striatulus,* has been uncovered recently which may well be called to the attention of other workers concerned. The writer was compiling a list of Minnesota snakes when he found a record[1] of a specimen of this species (*Haldea striatula*), which was collected by T. Glover at Fort Jackson, Minnesota. No such place as Fort Jackson could be found as ever having existed within the present boundaries of the state. The fact that Mr. Glover's collecting was confined to the Gulf States, coupled with the improbability of the record made it seem possible that the abbreviation for "Mississippi" on the original label might have been misread as "Minnesota." Dr. Doris Cochran, of the U.S. National Museum, at my request checked this record, and found that, as suspected, the entry should have read "Mississippi" instead of "Minnesota."

This erroneous record was evidently the basis for the statement of the range of this snake in Stejneger and Barbour's "Check List of North American Amphibians and Reptiles" as "Virginia and Minnesota south to Oklahoma and the Gulf States." It was included in "The Snakes of Iowa,"[2] also on the strength of the above Minnesota record. The northernmost record of this snake in the west appears to be well south of the Iowa state line in Missouri.—W. J. BRECKENRIDGE, *Museum of Natural History, University of Minnesota, Minneapolis, Minnesota.*

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[1] U. S. Nat. Mus. Bull. 24, 1882: 84.
[2] Iowa St. Agric. Exp. Sta. Bull. 239.

HERPETOLOGICAL NOTES FROM ZION NATIONAL PARK.—A small spotted night snake, *Hypsiglena o. ochrorhynchus,* was captured in Zion Canyon on June 14, 1934, by Assistant Superintendent T. C. Parker of Zion National Park, who picked it up at 8:15 P.M. on a clear day while it was crawling along the edge of the paved highway. Its total length was 167 mm., length of tail 25 mm. It was kept alive a few days to permit photographing it, and is now preserved in the Park Museum. This appears to be the fifth recorded specimen for Utah. Woodbury (Bull. Univ. Utah, 21, No. 5: 96), cites the following previous records: Fort Douglas (2 specimens); Zion National Park; and Big Cottonwood Canyon.

Another somewhat more common species collected in Zion National Park this year is *Diadophis regalis regalis,* which was secured during July, 1934, at an elevation of 4,450 feet, near water. It measured 607 mm. in total length, length of tail 116 mm. Woodbury records three other specimens from the Zion region. None of the Utah specimens show the transverse collar on the neck.—C. C. PRESNALL, *Zion National Park, Utah.*

NOTES ON THE FIVE LINED SKINK.—Along the west side of my house, at Avery Island, Louisiana, is a screened porch, sixty feet long, protected from the sun's glare by a three foot overhang of the roof. From the ground to the outside edge of this overhang, trained on wires, is a thick screen of evergreen vines. In these vines, and on the woodwork of the overhang protected from the weather by the roof, are each year numerous nests of wasps representing several different varieties of mud builders and paper builders. Some of the nests of *Polistes* are often more than six inches across.

A hollow in the trunk of an aged live oak (*Quercus virginiana*) growing about fifty feet from the house, had, for a number of years, been the home of an unusually large male five lined skink (*Eumeces fasciatus*), which, never having been frightened by us, often foraged in the vicinity of the house. Early in the afternoon of a day in August, I heard a great thrashing and shaking of the vines screening the porch. Thinking a *Coluber* was chasing a rat, I went quietly to investigate and was much surprised to see the skink vigorously shaking a large wasp nest (of *Polistes pallipes*). He was holding firmly to the vines, to which the nest was attached, with his hind feet, and having grasped the side of the wasp nest in his jaws, was violently shaking it from side to side. The adult wasps had all left their home, and only a few of them were in evidence buzzing about the foliage. It seemed strange to me they did not attack the despoiler of their nest, but those that could be seen seemed to be thoroughly cowed; only about six or eight of the more than thirty that belonged to this nest were in sight. After several vigorous shakes of the nest from side to side, the skink descended, carefully searching the foliage for, and eating, such immature wasps and grubs as his attack on the nest had caused to shake free, continuing his search to the ground. After eating all the victims he could find he returned to the nest and gave it a second vigorous shaking, dislodging more of its contents than he had by his first attack. On his second approach, the adult wasps that had returned to their home promptly left the nest without attempt at its defense, scattering about in the foliage where they buzzed angrily.

After a few minutes rest, he began creeping through the vines until he found a second home to despoil. This happened to be a nest of yellow jackets (*Polistes bellicosus*). His attack was leisurely but without delay. On reaching the nest he grasped the side nearest him in his mouth and began shaking it strongly from side to side. Three of the yellow jackets at once lit on his body, but apparently their stings could not penetrate his smooth hide. When they lit on him he loosened his hold on the nest and with quick side swings of his head plucked them from his body one by one, and after a quick crunch of his powerful jaws, swallowed them. After freeing himself of his attackers he again vigorously shook the nest, breaking it loose from its support. After a few more shakes he dropped the nest, and searched through the foliage to the ground, picking up and eating the grubs and immature wasps his efforts had shaken from the nest cells. These he appeared to locate by sight rather than by scent. He then came back to the nest which had lodged in the vines when dropped, gave it a few vigorous shakes, dislodging a few more grubs, for which he went to the ground, and then stretched out in a sunny spot just outside the vines. Thinking his feeding was over for the morning, I went back to my reading, but in such a position that I kept the skink in view. In about ten minutes he again ascended the vines and hunted out another wasp nest, a large one of *Polistes pallipes.*

His attack on this nest was positive and without hesitancy. As soon as it was located, he approached it from above, grasped its side in his jaws, and violently shook it from side to side, clinging to the vines with his hind feet. In shaking he used not only the muscles of his neck, but his back muscles as well, from his hind feet to his jaws. During the shaking process his front feet and legs were folded against his body. The amount of power put into this shaking was much more than I thought possible. As soon as he touched the nest most of the adult wasps beat a hasty retreat, only six of the more than thirty came to the defense of their home. These lit on his body and tried their best to use their stings, but without effect. I could see the long, black stings slide along the skink's smooth skin, but not one of them penetrated. The skink ceased shaking the nest when the defenders lit on him and keeping his hold on the vines with his hind feet he snapped the attackers off his body with quick side swings of his jaws and, giving each as he grasped it a strong squeeze, swallowed it. The nest was more than six inches across, and the vigorous shaking dislodged many grubs and immature wasps, probably as many as twenty, but did not break the nest from its fastening on the vines. After about a minute and a half of shaking, made in four periods of about one-fourth minute each, with short rests between each active period, the skink descended slowly through the foliage, searching carefully for any of the nest's contents that might have lodged in the leaves. On reaching the ground he held his head high in order to better see his prey, showing no undue haste in picking up his food. This repast satisfied him for the day, for he left the vines, went to his home tree and stretched out on one of the buttress roots.

On a number of other occasions that summer I saw this skink despoil wasp nests in the vines around my porch. He often broke small nests from their fastenings, but never did I see him try to tear one apart to get at the grubs sealed into their cells. He seemed content with what he could shake free. The wasps occupying the large nests did not desert them except while the attack was on, and returned when the skink moved on, as if nothing had happened, but at the end of that summer they deserted that locality, and have not since nested in these vines. When this skink first began his forays on the wasp nests in the vines shading my porch, I counted 32 nests, 20 of *P. pallipes*, and 12 of *P. bellicosus*. In 14 days he had attacked every one of these nests, breaking from fastenings 11, and leaving 21, those left being the largest and best supported.—E. A. McIlhenny, Avery Island, Louisiana.

A CASE OF *OXYBELIS* POISONING IN MAN.—The scarcity of information concerning the venoms of opisthoglyph snakes seems to justify the publication of some notes on a case of *Oxybelis* poisoning which recently came to my notice.

While transferring a specimen of *Oxybelis* from a container to an exhibit case at the Reptile Garden of the Witte Memorial Museum of San Antonio, Texas, on August 28, 1937, Mr. C. D. Orchard was bitten on the middle phalanx of the right forefinger toward the thumb. Between ten and twenty seconds elapsed before the snake's jaws were pried off. From this it seems likely that enough venom was injected to produce a significant reaction. As the fangs penetrated the skin, the left to a depth of approximately three sixty-fourths of an inch and the right a trifle less, an almost imperceptible prick was felt. This was followed about five minutes later by an itching sensation similar to that caused by the sting of nettles. A slight redness and a little swelling accompanied the itching. At ten minutes after the bite the itching had ceased, the middle phalanx was a trifle numb, the swelling had increased somewhat, and near the deepest fang puncture a large blister was forming. At fifteen minutes the swelling had decreased considerably and the redness, except in the immediate vicinity of the fang marks, had disappeared. Twenty-four hours later the blister still contained fluid. Four days later the skin had peeled from the fang marks and the blister. Impelled by curiosity, Mr. Orchard made an incision on his left thumb and rubbed into it some of the fluid from the blister. The result was another blister. The only treatment was incision and suction without a tourniquet. All sensations and reactions, other than the experimental incision on the left thumb, were localized in the phalanx bitten.

The snake, probably *Oxybelis fulgidus*, was captured among boulders in a small canyon below Horsetail Falls, about 35 kilometers south of Monterey, Coahuila.—M. L. Crimmins, *Witte Museum, San Antonio, Texas.*

COURTING AND EGG-LAYING HABITS OF *PHRYNOSOMA CORNUTUM*.—Two specimens of *Phrynosoma cornutum* were collected from different localities on April 19, 1936. While they were being held in the writer's hand one of the lizards grasped the other by the loose skin back of the left fore leg and held on tenaciously. When placed upon the ground the female tried to escape but was held firmly by the male. After the female had subsided, the male grasped her left horn and began to scratch the dorsal region back of the fore legs. Following this irritation the female lizard turned her posterior ventral surface to one side and the male placed his cloacal aperture over that of the female. The female was never on her back but was in a twisted position. With vigorous activity the male everted the copulatory organ and inserted it into the female cloaca. A close examination revealed that the semen passed along a groove in the copulatory organ. The complete courting and copulation processes occupied sixteen minutes.

The female lizard was placed in a wire enclosure with an earthen floor where her activities could be observed. On June 2, forty-four days after copulation, the lizard began excavating a hole in the soil at 10 A.M. By 5 P.M. she had deposited fourteen eggs in a hole about four inches from the surface of the ground and at an angle of about 45°. The eggs were carefully covered with dirt and the ground surface appeared undisturbed.

The eggs were collected at regular intervals and fixed for later embryological studies.

A similar courting behavior was observed in a terrarium containing several lizards. In this instance the male was a large *P. b. blainvillii* from Pasadena, California, and the female was a specimen of *P. cornutum*. Copulation was not observed.—WILLIS G. HEWATT, *Texas Christian University, Fort Worth, Texas.*

NOTES ON *CONIOPHANES IMPERIALIS* (BAIRD).—*Coniophanes imperialis*, which ranges from southern Texas to Vera Cruz, is found in much of Cameron and Hidalgo counties in the Rio Grande Valley in Texas. Four adult specimens were taken during early mornings in March, 1936, within one block in Harlingen, Texas. They measured in cm. 49, 45, 42, and 31. Two of these had incomplete tails, which seem to break off easily in this species. They lived in captivity over twelve months, burrowing in the sand during the day and coming out at night or early in the morning.

Though these opisthoglyph snakes never make an effort to bite when caught or handled, they are very restless and excitable. They readily take small toads which they grasp without striking. One snake was found holding a large toad by the leg. The toad escaped and appeared uninjured, but died in a few minutes. It is possible that the snake had injected sufficient venom to kill it.

In June, 1936, one of the snakes laid four granular capsule-shaped eggs. These averaged 18 mm. in length and 8 mm. at midsection. They were placed in moist sand, but shrank and mildewed soon after. It was not known whether they were fertile.—BRYCE C. BROWN, *Harlingen, Texas.*

THIRD RECORD OF *ASCAPHUS TRUEI* IN CALIFORNIA.—On June 25, 1934, Mr. Mitchell Hanavan, scientific assistant of the U.S. Bureau of Fisheries stream survey party of which the writer was leader, found a larva of the American bell-toad, *Ascaphus truei* Stejneger, in French Creek, a tributary of Scott River, Siskiyou County, California. This is believed to be the third record of this infrequently seen salientian for California. The exact locality is Township 40 N., Range 9 W., Section 5, not far from Craggy Peak, near Callahan, the original California collection locality. French Creek at this altitude, 3800 feet, is a rapid, clear stream. The temperature of the water was 52° F., the flow 3 cubic feet per second, the average width of the stream 5 feet, and the average depth 6 inches.

The present specimen is a nearly mature tadpole, with posterior limbs well developed and no front limbs. The color in life was dark brownish gray, with greenish and bluish iridescence. The round milk-white spot at the tip of the tail, recorded by G. S. Myers (COPEIA, 2, 1931: 56–57) for specimens from Humboldt County, California, is absent. The specimen has been deposited in the Natural History Museum of Stanford University, Amphibian Cat. No. 2190.—LEO SHAPOVALOV, *California Division of Fish and Game, Natural History Museum, Stanford University, California.*

Ichthyological Notes

NOTES ON *RAJA KINCAIDII* GARMAN FROM THE PACIFIC COAST.[1]—*Raja kincaidii* Garman (1908)[2] and Garman (1913)[3] appear to be the only references to the actual capture of this species, and these are based on a single specimen, the type, in the Museum of Comparative Zoology, Harvard. From the foregoing evidence it might be concluded that the species is rare, but recent specimens collected by Richard T. Smith, State Fisheries Department, Seattle, Washington, indicate that it is one of the common skates in the Puget Sound region. Garman's somewhat misleading description has been the reason for the lack of recent records of its occurrence. The following description, based on 19 specimens, should enable the student of fishes to identify this species more easily than has been possible in the past:

DESCRIPTION.—The curves on the anterior side of the disk are variable. In the young up to a foot in length, the disk is usually rounded anteriorly, but in larger specimens and adults up to two feet long the disk is usually undulating, first convex at each side of the snout, then concave, rarely a little convex in certain specimens, then always convex at the outer pectoral angle. The interorbital space in all the specimens examined was flat to concave, usually concave, instead of convex as described; other characters are essentially as described by Garman.

The color of the back is slaty in the adults to leaden-brown in the young. The small brown spots on the dorsal surface seldom persist after the fish reaches one foot in total length. The pair of white spots on each side of the tail in the vicinity of the 17th to 19th spine of the series along the mid-line of the back occurred in but 6 of the 19 specimens examined. The faint spot of light color near the middle of the hinder half of each pectoral fin is seldom visible in specimens much over one foot long. The lower side of the tail is dark-brown along its middle, usually blotched anteriorly.

The counts and measurements given below were taken from specimens in the United States National Museum as follows: U.S.N.M. 77494, 2 medium sized fish with broken tails, from Oval Bay, British Columbia, collected by Dr. W. F. Thompson; U.S.N.M. 77403, one male specimen, 545 mm. total length, *Albatross* Station 4507, Pt. Pinos Light, California, April 11, 1904; U.S.N.M. 77404, one male specimen, 362 mm., *Albatross* Station 4414, N.W. Pt. Santa Catalina Island, California, May 20, 1904; U.S.N.M. 103416 to 103430, 15 specimens, 4 females and 11 males, 252 to 680 mm. total lengths, collected by Richard T. Smith and Captain Knudsen on the Otter Trawler *Uranus* near Alden Bank, southwest of Point Whitehorn, Washington, in 30 to 38 fathoms, during January and February, 1936.

COUNTS AND MEASUREMENTS OF *Raja kincaidii*.—The following figures for each character show, first, the minimum and maximum count or measurement, and in parentheses, the number of specimens counted or measured, followed by the mean and probable error of the mean, respectively. The measurements are expressed as hundredths of the total length unless otherwise indicated.

The number of spines in the mid-line of the back, 27 to 33 (19) 30.21 ± 1.10; number of spines on each shoulder besides those in the mid-line series of the back, left 1 or 2 (19) ± 1.42, right 1 or 2 (19) 1.42±; width of disk (this width was obtained by measuring the distance between the outer pectoral angles) 58.0 to 68.9 (16) 61.82 ± 1.71; length of disk (the length of the disk was obtained by measuring from the tip of the snout to the middle of a line touching the posterior angles of the disk, i.e., pectorals) 44.0 to 54.9 (16) 49.82 ± 1.60; width of interorbital 3.5 to 5.9 (16) 4.45 ± 0.41; length of snout 10.0 to 13.9 (16) 11.51 ± 0.73; length of tail (the length of the tail is the distance from the anterior edge of the anus to the posterior tip of the caudal) 55.0 to 60.9 (16) 57.89 ± 0.80; distance from tip of snout to anterior edge of the anus 40.0 to 45.9 (16) 42.39 ± 0.95; the width of the disk is contained from 0.71 to 0.83 (19) 0.81 ± 0.20 times in the length of the disk; the length of the snout is 4.51 to 5.90 (19) 5.25 ± 0.34 times in the width of the disk; the width of the interorbital space is 2.3 to 3.30 (19) 2.63 ± 0.54 times the length of the snout.

[1] Published by permission of the Secretary of the Smithsonion Institution.
[2] *Bull. Mus. Comp. Zool.*, 51 (9): 254.
[3] *Mem. Mus. Comp. Zool.*, 36: 343, Pl. 17b, Fig. 3.

To identify this skate in the Puget Sound region, the key on pages 131 and 132 of the recent publication by Schultz (1936), *Key to the fishes of Washington, Oregon, and closely adjoining regions,*[4] must be modified as follows: "2b" should become "3c" and read thus: "Shoulder girdle with 2 to 4 spines; orbital rim without spines; width of disk about 7/10 to 8/10 in length of disk; tail longer than length of disk by 8/10 to 1½ length of snout. Range: British Columbia to Santa Catalina Island, California.

Raja kincaidii Garman."

LEONARD P. SCHULTZ, *United States National Museum, Washington, D.C.*

CHANGE IN TYPE LOCALITY OF *DEMICOILIA MARGARITIFERA* JORDAN AND SEALE.—While cataloguing the Engraulidae at the Museum of Comparative Zoology, Cambridge, the past winter, the type locality of *Demicoilia margaritifera* Jordan and Seale, as published (Review of the Engraulidae, with descriptions of new and rare species, by Jordan and Seale, Bull. Mus. Comp. Zool., 67 (11), May, 1926: 364), was found to be an error. Instead of Colombo, Ceylon, the locality should be East Indies. Also, the locality for *Coilia dussumieri* Cuvier and Valenciennes, M.C.Z. No. 17, 957 (*ibid*: 361), should be East Indies instead of Ceylon.—WILLIAM C. SCHROEDER, *Museum of Comparative Zoology, Cambridge, Massachusetts.*

A FISH NEW TO MASSACHUSETTS BAY.[3]—The spot (*Leiostomus xanthurus*) regularly ranges in summer as far north as the southern shore of Cape Cod but has not been recorded for Massachusetts Bay or any other locality to the northward and eastward of Cape Cod. The species is not mentioned in Bigelow and Welsh's "Fishes of the Gulf of Maine."

It is therefore a matter of interest to note the capture of a specimen in Massachusetts Bay by the otter trawler *Anna* of New Bedford, whose Captain Warren Vincent presented the fish to the United States Fisheries Station at Woods Hole. The place of capture was off the shore between Plymouth and the Cape Cod Canal, and the date was November 23, 1936.

This occurrence is of interest for several reasons besides the extension of the known range of the species. The possibility, if not the probability, that the fish gained access to Massachusetts Bay from Buzzards Bay through the Cape Cod Canal is to be considered, for spots are found every year at the head of Buzzards Bay near the canal entrance. The late date of capture is noteworthy, as the fish normally leave the vicinity of Woods Hole before the end of October and are not seen again until spring. The winter of 1936–37 was exceptionally mild in the Cape Cod region.

The size of the specimen is unusual and apparently constitutes a record for Massachusetts. The total length is 30.5 cm.; the length to the base of the caudal fin is 25.3 cm.; the depth at the origin of the spinous dorsal fin is 8.9 cm.; and the length of the head is 7 cm. The usual length of spots in the Woods Hole region is rarely over 15 to 17 cm.—HUGH M. SMITH and ROBERT A. GOFFIN, *Woods Hole, Massachusetts.*

YOUNG *CARANX RUBER* (BLOCH).—Prior to 1937 I was unfamiliar with the young of *Caranx ruber,* and questioned whether this species had a deep-bodied drifting stage characteristic of most species of the genus (Natural History [N. Y.], 36, 1935: 268). The Michael Lerner Bimini Expedition of that year found small *C. ruber* to be the abundant *Caranx* among drifting gulf-weed in the easterly edge of the Gulf Stream off Bimini, Bahamas, July 19–22. At the smallest sizes they are only slightly less deep-bodied than corresponding *C. bartholomaei,* the closely related deep-bodied form characteristic of the weed. Sixteen specimens from 17.5 to 23.5 mm. standard length have depths ranging between 2.1 and 2.5, irrespective of size (average 2.29). At 24 mm. they become appreciably more slender, 5 of that length varying in depth between 2.3 and 2.5 (average 2.38); 13 measuring from 24.5 to 30 mm. vary between 2.4 and 2.6 (average 2.49); 7 measuring from 31 to 35 mm. vary between 2.5 and 2.6 (average 2.57); and 2 measuring from 37 to 43 mm. have depth 2.7. Presumably they become more active and independent of the shelter of the weed at about this size. The average depth at 17.5 to 23.5 mm. corresponds to that of *C. bartholomaei* at 35 to 70 mm., at 24 mm. to that of *C. bartholomaei* at 70 to 140 mm. (COPEIA, 80, 1920: 29).

[4] *Univ. Wash. Pub. Biol.,* 2 (4): 103–228.
[3] Published by permission of the Commissioner of Fisheries.

The color of these specimens when they reached the American Museum of Natural History in formalin was mostly more or less rather clear yellow below, olive above, the sides sometimes with faint, narrow, paler vertical cross-bars; and the viscera usually showed through as reddish; spinous dorsal dusky grayish, and other vertical fins and ventrals more or less orange, the lower caudal lobe tending to be brighter than the upper (largest specimen with the upper pale, lower more or less orange dusky) foreshadowing the diagnostic black mark on the lower caudal lobe of the adult. A minority were paler, or more dusky, and without yellow. A few *C. bartholomaei* of corresponding sizes collected with them were not notably different in color except for blacker spinous dorsal, dusky ventrals, and in one example a dusky slanting bar above the eye.

All are said to have been uniform bright silvery in life, the *C. bartholomaei* not distinguishable from the *C. ruber;* but a single *C. hippos* with dark cross-bands was at once seen to be different (F. R. LaMonte). When actually among the weed *C. ruber* may have a color pattern, that is even more delicate and ephemeral than that of *C. bartholomaei.*—J. T. NICHOLS, *American Museum of Natural History, New York City.*

VARIATIONS IN THE MASKINONGE IN THE SAUBLE RIVER, ONTARIO.—A peninsula separates the Georgian Bay from the upper part of Lake Huron. The Sauble River, not more than twenty miles in length, traverses this peninsula and runs into Lake Huron at its base. The author has fished this river for some twenty-five years and has caught about twenty-five maskinonge in that time. Remarkable variation is shown by the fish taken, which seem to fall into three categories. Of eight specimens represented in my collection, four are of the barred type with 133 to 140 scales in the lateral line and cheeks completely scaled, three are of the spotted type with 158 to 159 scales and lower half of the cheeks naked, while one known locally as "green maskinonge" is largely devoid of dark markings. It has 165 scales and lower half of cheeks naked. Details of scale, fin ray and branchiostegal numbers and character of the cheek scaling is given in the following table.

Number	Scales in lateral line	Dorsal Rays	Anal Rays	Branchiostegals	Scaling on cheek
Barred type					
1	133	18	16	18	Complete
3	140	20	17	?	"
4	140	?	18	19	"
6	135	18	17	?	"
Spotted type					
5	158	?	18	16	half-scaled
9	158	19	17	18	"
11	159	20	18	19	"
Green Maskinonge					
	165	20	19	18	"

The color and pattern of the three types are as follows:

BARRED TYPE: Back, a very dark green verging on black; sides a dark green above shading into lighter green below with bars of golden yellow running irregularly downward and a little forward as far as the belly; belly white and unspotted; fins and tail spotted.

SPOTTED TYPE: Back a dark green; sides shade rapidly from the green of the back to a light green and greenish white. Superimposed are spots of a darker green. The shape and size of these spots suggest that they could be made by applying green paint with the finger tips; belly white, spotted with dark. The spots on the front of the belly are small; dorsal and anal fins are spotted; the paired fins and the tail are unspotted.

GREEN MASKINONGE: Back a dark green; sides shade down from a dark green above to a light green below without showing any spotting or barring, but the lower edge of the side coloring is wavy and irregular; belly whitish, with spots of green varying from the size of bird shot to that of a small bean; fins and tail show no spotting. In the fresh state these were a transparent red, resembling the coloring of the fins of a red horse (*Moxostoma*).

In some respects these three types suggest three forms, sometimes regarded as subspecies and sometimes[1] as species under the names *ohioensis, masquinongy* and *immaculatus*. It has never been suggested, however, that these forms differ in the number of scales, along the lateral line nor in the scutellation on the cheek. Moreover, the three forms usually recognized are regarded as having different distributions. All of the specimens

[1] Pike, Pickerel and Muskalonge. Zool. Leaflet 9, Field Mus. Nat. Hist.

described in this paper, however, have been taken from one small river.

Old residents of the locality report that the green maskinonge was once much more common than at present. As a matter of fact, it now appears to be almost extinct. Does this suggest that this was the original type of the locality and that the arrival of a new form, possibly of the barred type, has resulted in the gradual disappearance of the original one and that the spotted type may be a hybrid between the other two? The intermediate number of scales in the lateral line of the spotted type lends some support to such a theory. Whatever the explanation, there is indicated a most interesting problem yet to be settled.—EDWIN SEABORN, M.D., F.A.C.S., LT. COL., C.A.M.C., *London, Canada.*

RECORDS OF *PSEUDOPRIACANTHUS ALTUS* (GILL) AND *FUNDULUS MAJALIS* (WALBAUM) FROM THE GULF OF MAINE.—A specimen of *Pseudopriacanthus altus,* 38 mm. long, was taken in a tide pool at Cohasset, Massachusetts, September 7, by Mr. F. G. Bemis, Jr., and sent to the Museum of Comparative Zoology, Cambridge, by Mr. B. Preston Clark. Although the young of this species are taken from time to time along the southern New England coast in summer, this is the first record noted from within the Gulf of Maine since the capture of a specimen on Marblehead Beach in September, 1859.

Four specimens of *Fundulus majalis,* 46–54 mm. long, were taken by Mr. Clark near Cohasset, Massachusetts, in September. This is of interest because the only previous Gulf of Maine records are for the vicinity of Boston many years ago.

Widening of Cape Cod Canal has been in progress for some time and it is possible that both these species may have entered Cape Cod Bay by that route rather than by rounding Provincetown. If this be true, we can expect in the future an increasing number of capture records for the north side of Cape Cod of species which, although not uncommon along the southern coast in summer find the outer coast a barrier to their progress northward.—WILLIAM C. SCHROEDER, *Museum of Comparative Zoology, Cambridge, Massachusetts.*

THE OCCURRENCE OF *PORONOTUS TRIACANTHUS* IN THE GULF OF ST. LAWRENCE.—On July 20 two butterfish (*Poronotus triacanthus* Peck) were gilled in a salmon trap operating 1½ miles southwest of Margaree Harbor, Cape Breton Island. One of the specimens was taken in the morning, the other in the evening. We were able to preserve only one of them. This fish measured 26.4 cm., and was in excellent condition. The other specimen was said to be of about the same size. Although many of the native fishermen are familiar with the butterfish, having fished it elsewhere, none of them had ever before seen it at Margaree Harbor.

The literature shows that butterfish have been taken repeatedly on the outer coast of Nova Scotia and as far north as Canso (Cornish, 1907), but that they have been recorded from the Gulf of St. Lawrence only once. Pierre Fortin (1865: 65) lists this form from the Quebec coast as "rarely found on our coast" and "a specimen taken at La Pointe St. Pierre."

The size of our fish from the Nova Scotian coast of the Gulf should be noted. Bigelow (1924) states that the largest butterfish "are about 10½ inches long" (26.5 cm.), but that the run is "about 6 to 8 inches" (15 to 20 cm.). This 26.4 cm. specimen is of importance, then, not only because of the rarity of butterfish in the Gulf but also because of its size.

LITERATURE CITED

BIGELOW, H. B.
1924 Fishes of the Gulf of Maine. *Bull. U. S. Bur. Fish.,* 40, Pt I.

CORNISH, G. A.
1907 Notes on the fishes of Canso. *Rept. Dept. Mar. and Fish. Canada,* 1902–1905 (1907), Ottawa.

FORTIN, P.
1865 Rapport annuel de Pierre Fortin. Hunter, Rose et Lemieux, Quebec.

WILLIAM S. HOAR, *Boston University School of Medicine, Boston, Massachusetts.*

REVIEWS AND COMMENTS

MONOGRAPHS ON THE FISHES OF THE IBERIAN PENINSULA AND MADEIRA.—Comments are offered on four recent general treatises on Spanish, Portuguese, and Madeiran fishes, the publication of which indicates the increasing interest in ichthyological work in Spain and Portugal. [These reviews were written before the present terrible holocaust in Spain, which will certainly retard scientific work there for a long period. No word has been received from Drs. de Buen and Lozano for many months, and their fate is unknown.]

FAUNA ICTIOLÓGICA. CATÁLOGO DE LOS PECES IBÉRICOS: DE LA PLANICIE CONTINENTAL, AGUS DULCES, PELÁGICOS Y DE LOS ABISMOS PRÓXIMOS. By Ferdando de Buen. *Instituto Español de Oceanografía, Notas y Resúmenes,* Ser. 2, Nos. 88 and 89, 1935: 1–149, figs. 1–115.—Prof. de Buen's check-list is the latest of a long series of excellent papers originating in his laboratory in Madrid. In the two parts that have so far appeared he has done much to bring about the long-delayed modernization of the nomenclature of European fishes. Since, in sending out reprints, he has particularly asked for corrections to be included in an addendum, the reviewer does not take added space to include notes on any errors or omissions at this time. Prof. de Buen is to be congratulated on his industry and his desire to bring Spanish ichthyology nto accord wth modern trends.

LOS PECES FLUVIALES DE ESPAÑA. By Luis Lozano Rey. *Mem. Acad. Cienc. Madrid,* (Ser. Cienc. Nat.) 5, 1935: i–xi, 1–390, 28 pls.—Dr. Lozano's useful treatise on Spanish fresh-water fishes is the first extensive attempt to monograph this fauna, and forms a worthy companion volume to his excellent book of 1928 on the elasmobranch fishes of Spain. He, too, has taken notice of recent literature more than is customary with writers of European faunal works on fishes, and has produced a monograph that will be welcomed by those who have tried to utilize the vast and confusing literature of European ichthyology. In regard to Dr. Lozano's account of the introduced *Gambusia,* the reviewer wishes to point out the misspelling of *Gambusia holbrookii* and also to note that it is very probable that more than one form of *Gambusia* has been introduced into Spain. Several years ago German aquarists imported from Spain a *Gambusia,* which, from illustrations in the aquarium literature, looked much like the Texas *G. senilis.*

FAUNA MARINHA DE PORTUGAL. I. VERTEBRADOS (MAMÍFEROS, REPTIS E PEIXES). By Augusto Nobre. Portô, Portugal, 1935: i–lxxiv, 1–579, 77 pls.—Prof. Nobre's monograph of the marine vertebrates of Portugal covers the marine mammals and two marine turtles, as well as the fishes. Unfortunately, the work is not very critically compiled, and the author does not seem to have been familiar with most of the progress that has been made in European systematic ichthyology in the last two decades. We note with concern the confusion of the eastern European Goby, *Gobius fluviatilis,* with a cyprinid, the common Gudgeon (*Gobo fluviatilis* or *G. gobio*) on page 370. Despite its imperfections, this work will be of use as a compendium of general information and as an index of the literature.

OS PEIXES DOS MARES DO MADEIRA. By Adolfo Cesar de Noronha and Albert Artur Sarmento. Diario de Noticias, Funchal, Madeira, 1934: 1–146, 14 illustrs.—The paper on Madeira fishes by Messrs. de Noronha and Sarmento is the first general work on the fishes of these islands by *Madeirenses.* The text and figures are concerned largely with fishing and fishing methods, the fishes themselves being mentiond in an alphabetical list arranged according to the common Madeiran names. This paper would be especially valuable to one going to Madeira to collect representatives of its remarkable deep-water fish fauna, brought up from the depths in the famous long-line fishery that has produced so many ichthyological treasures. It may be noted that one remarkable species, *Diplogonurus maderensis,* described previously by Noronha and mentioned in this paper on page 109, deserves further study, due to its similarity to the rare *Xenogramma carinatum* Waite, recorded from Lord Howe Island, Japan, and California.[1] Further, the Madeiran

[1] See Myers, Trans. San Diego Soc. Nat. Hist., 7 (11), 1932: 113, pl. 7.

deep-water shark, *Squaliolus sarmenti* Noronha, seems to be the same as the Philippine *Squaliolus laticaudus* Smith and Radcliffe, according to a direct comparison of the holotypes of the two species made by Mr. Arthur W. Henn.

These four papers, together with Fowler's new "Marine Fishes of West Africa," provide us with vastly better tools for study of the fishes of the eastern Atlantic and Iberian Peninsula than we have had in the past.—GEORGE S. MYERS, *Natural History Museum, Stanford University, California.*

THE SNAKES OF NEW JERSEY, A GUIDE. By Harold Trapido. The Newark Museum, Newark, N.J., 1937: 1–60, 52 figs.—It is pleasant to record a newcomer to the long list of state guides and handbooks, with the hope that it may be the precursor of renewed studies on our North American fauna in an area of strategic importance. The study of natural history in general and of geographic distribution in particular by means of state lists and handbooks is theoretically quite illogical. In practice, however, such works have proved to be effective, if not indispensable. With their increase in number, they form a mosaic of the distribution of our fauna, and it is doubtful if a more effective means of getting studies made and published could have been devised.

Such lists may range from the completely technical, directed primarily to the scientific fraternity, to the completely popular, primarily for amateurs and for school use. Mr. Trapido's work is of the latter kind, but with so many evidences of original work and of new information that the reviewer would have liked to have such matter more readily identifiable. The author's stated purpose, the facilitation of the identification of the snakes of New Jersey, is excellently fulfilled by the brief text and fine illustrations.

So elementary a book should have had a little more introductory matter, and in particular, an explanation of the form and use of scientific names. Handbooks of this kind should include brief suggestions for natural history studies, since in the observation of breeding habits, hibernation, and various other extremely interesting topics, the advance of our knowledge depends on the intelligent and critical amateur. References to various pertinent books and papers would suggest to the reader opportunities for worthwhile observation. It appears from the text (p. 14) that *Diadophis punctatus punctatus* occurs in New Jersey, and this sub-species should have been added to the list.

The charm of the New Jersey fauna is well known to the reviewer, who would like to see a renewed "complete" account of the amphibians and reptiles of the state drawn up on such a scale as to satisfy both the student and the nature-lover.—KARL P. SCHMIDT, *Field Museum Natural History, Chicago, Illinois.*

BIOLOGICAL TIME. By P. Lecomte du Noüy, with foreword by Alexis Carrel. The Macmillan Co., New York, 1937: i–xiv, 1–180, figs. 1–41. $2.00.—In these days of literary compression in technical reports, it is refreshing for a change to gain scientific information from a narrative account of the observational and mental processes used by an analyst in reducing a more or less heterogeneous mass of observational data to an orderly form amenable to mathematical description. In this way, from part II of *Biological Time,* we learn that fundamentally the healing rate of wounds is a function of their size and of the age of the patient. When size is mathematically discounted, the residual curve depicts rapid mending at ages 15 to 25 years, and a gradually declining rate toward the age of 50. The author is impressed by the similarity of this curve to that expressing the rate of proliferation cells in tissues cultured on blood serum derived from animals of different ages. Although he makes no examination as to whether the observational results in the two series differ significantly from each other in the statistical sense, his argument that the two processes have much in common and that both mending of wounds and proliferation of tissues in culture are affected by progressive changes of blood plasma seems quite acceptable. Whether or not these changes are really an accumulation of toxins as stated would seem to require further proof. Be this as it may, biologists will be impressed by the similarity of both curves to the usual curves of growth of those fishes and invertebrates which do not stop growing when adulthood is reached.

Whether or not parts I and III are worthwhile depends on readers' tastes. To my

mind, part I, dealing with investigational methods and logic is marred by the scissors-and-paste method of stringing references together; and part III, erecting the concept of an internal physiological time which flows faster (in terms of sidereal time) in the young than in the old—a relativity of time, so to speak—seems somewhat over-done.—O. E. SETTE, *Jordan Hall, Stanford University, California.*

THE TURTLES OF ILLINOIS. By Alvin R. Cahn. Illinois Biol. Monogr., 16: pp. 1–218, pl. 1–31, 15 text figs., 20 maps. $3.00.—Herpetologists will be the more disappointed in this work because of the dearth of usable accounts of the American turtles, on which the author rightly comments. It is difficult, in drawing up a criticism of it, to disentangle faults due to the all too frequent breakdown of critical and effective editorship of scientific journals, from those which may justly be laid at the door of the author. The principal merit of the work is in graphic presentation of the distribution of the turtles in the state, and notwithstanding the reviewer's adverse comments below, every American herpetologist will want it on his shelf. The reviewer's criticisms are that it is curiously diffuse and padded, in both organization and language; that its acceptance of other herpetological work is uncritical; that while a list of Field Museum specimens was obtained, the collection was not examined; that the illustrations are unnecessarily unsuccessful on account of the black background; and that there appears to be a major error of identification.

The diffuseness of organization pervades the work. Full lists of generic and specific synonyms, appropriate to a taxonomic monograph, appear out of place in a faunal paper. The descriptions are unduly extensive, with no emphasis of the diagnostic characters, and not uniform in style; the attempts at literary embellishment, in the sections in habitat and habits, are out of place in the framework of technical description and synonymy; it is difficult to disentangle new observations made in Illinois from the generalized descriptions of habits; the tables of measurements are given in full, and neither analyzed nor arranged in any useful order. Under *Chrysemys* the discussion of the problems of intergradation of the subspecies of *picta* in Illinois is largely repeated under each of the three forms, while the summary (p. 128) is unintelligible; *Chrysemys treleasii,* duly discussed under *bellii,* reappears in the list of hypothetical species at the end of the work. The treatment of *Pseudemys troostii* is equally repetitious. The second Illinois species of *Pseudemys,* described under the name of *concinna,* seems to the reviewer to be obviously *Pseudemys hieroglyphica.*

The halftone figures (misnamed plates), buried in the text, are from photographs excellent except for their black background. This results in unsatisfactory halftones, in which the outlines of the turtle are frequently lost. The line cuts are much better and the maps excellent. There is no index.—KARL P. SCHMIDT, *Field Museum of Natural History, Chicago, Illinois.*

ILLUSTRATED GUIDE TO THE FISH GALLERY. By J. R. Norman. British Museum (Natural History), London: i–ix, 1–165, figs. 1–100, colored frontispiece, paper. 1/6 (England) or 37c (America). This work serves as a guide both to the Fish Gallery in the British Museum, and to the study of fishes in general. It should serve also as a model for similar guides to fish galleries in American museums. It is entertainingly written and amazingly comprehensive and informative for its size and price.—L. A. WALFORD, *Jordan Hall, Stanford University, California.*

THREE NEW ASIATIC CHECKLISTS.—Checklists, if they are done carefully and cover wide enough areas, are great time savers in systematic work on faunas not recently monographed. The three new lists now reviewed will take their places beside the recent Australian and Chinese lists of McCulloch and Chu as very useful tools.

INDEX TO FISHES OF SIAM. By Chote Suvatti. Bureau of Fisheries, Bangkok, Siam, 1936 (published December 5)[1]: i–vi, 1–226, 1 pl., 1 map.—This is a bibliographic checklist; it attempts to give a page reference to every record of a Siamese fish, and apparently succeeds well. Although no statement to the effect is made, the list appears to be based to a very large extent on a manuscript checklist prepared for the Siamese Bureau by Dr. Hugh M. Smith, of which a second copy exists in the Division of Fishes in the U. S. National Museum. It is unfortunate that two or three extensive papers on Siamese fishes

[1] The reviewer's copy was received in January, 1937.

by Fowler were published too late for inclusion. There are indexes, both to the Siamese and the scientific names.

A CHECK LIST OF PHILIPPINE FISHES. By Hilario A. Roxas and Claro Martin. Dept. of Agriculture and Commerce, Manila, Technical Bulletin No. 6: 1–314. Like the last, this is a bibliographic list giving a page reference to each record, and as far as actual Philippine records go, it appears to be very complete. The basis of the paper appears to have been a manuscript list compiled in Manila ten or more years ago by Dr. A. W. Herre, assisted by Lucia Manikis and Claro Martin, but which has evidently been entirely reworked and greatly extended. Despite the laudable industry of the authors, the list displays a lack of both critical judgment and of knowledge of fish classification. This lack is most glaringly demonstrated by the authors' inclusion of the strictly neotropical and Ethiopian family Characidae in the Philippine fauna, caused by blindly following an unfortunate error in Jordan's *Classification of Fishes*.[2] In a number of instances the same species appears in two places under different generic names,[3] and in others (e.g., *Barbus* and *Barbodes*) the authors have apparently not realized that the mere usage of different generic names does not necessarily mean that the species belong to different genera. Probably the worst confusion is to be seen in the Pomacentridae (plus the "Chromidae," etc.), where the authors, without attempting the necessary reconciliation of the radically different classifications proposed almost simultaneously by Montalban and by Fowler and Bean, have on top of this uncritically adopted Whitley's new system of genera.[4] Finally, some recent important revisional papers do not seem to have been known to the authors.

It should be noted that the excellent and painstaking editing and indexing of this volume formed the last labor of the late Richard Crittenden McGregor.

A REVISED CATALOGUE OF THE FISHES OF KOREA.—By Tamezo Mori and Keitaro Uchida. Journ. Chosen Nat. Hist. Soc., No. 19, 1934: 1–23.—This is merely a list of 522 names, without ranges or bibliography.—GEORGE S. MYERS, *Stanford University, California.*

UEBER DIE NAHRUNG VON *Rana temporaria* L. By B. A. Krassavzev. Zool. Journ. (Upravle Univ. Narkomprosa), 14(3), 1935: pp. 594–600, tables.—The author studied 230 stomachs of *Rana t. temporaria* collected in the Nizhni-Novgorod and Vladimir regions (Russia) over a period of 3 years. As many habitats of the frogs as possible were represented by the collections as were the months, May to October, and all hours of both day and night. The principal feeding period is from evening to early morning, hence diet comprises mainly nocturnal invertebrates. It is probable that the frogs feed during the mating season and certain that they take food after the first frosts. The composition of the diet changes from month to month in correspondence with that of the fauna of the environment. No difference was found in the food of the sexes. Tables give the food species and the frequencies of their occurrence. Earthworms, snails and slugs, phalangids, myriapods, dragonflies, leaf-hoppers, plant-lice, beetles, mosquitoes, and caterpillars are important elements.

An equation is suggested for the expression of the economic significance of food habits, $U = \frac{V - u.a.}{c.q.}$, in which U stands for utility, V for the number of injurious forms eaten, $u.a.$ for that of the beneficial forms, and $c.q.$ the total of all food items, useful, injurious, and neutral. U may vary from $+1$ to -1, the first result signifying exclusive utility, the second entire harmfulness. For the frog *Rana t. temporaria*, the author's studies give a utility index of $+0.6$.—W. L. MCATEE, *Biological Survey, Washington, D. C.*

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[2] The late Dr. Jordan did not have access to Müller and Troschel's description of *Cnidon*. Not only is *Cnidon* not a characin, but it is placed correctly in the synonomy of *Psammoperca* in Boulenger's catalogue of perciform fishes.

[3] One example is *Nesogrammus piersoni* and *Gramatorcynus bicarinatus;* in the list they appear in different families.

[4] Although the papers of Montalban and Fowler and Bean appeared at almost the same time, Montalban's was published first, copies having been seen by the reviewer before Fowler and Bean's bulletin was off the press. I am therefore unable to understand why Roxas and Martin meticulously subordinate Montalban's paper by quoting it throughout as if it had appeared later than Fowler and Bean's, even using a date in the references different from the one in the bibliography.

EDITORIAL NOTES AND NEWS

Aid to Copeia

FINANCIAL aid in the publishing of this issue of COPEIA has been received from the American Wildlife Institute, and from the Lerner Expedition.

Annual Meeting

THE Board of Governors has voted to hold the 1937 annual meeting of the Society at Berkeley, California, during the week of July 19 to 23. Additional details regarding the meeting will appear in the next number of COPEIA.

Willy Wolterstorff

DR. WILLY WOLTERSTORFF, one of our recently elected Honorary Foreign members, has been studying the salamanders of his native Germany for more than sixty years. His success in breeding these creatures in captivity has been phenomenal, and will have a long continued influence in other fields of zoology. He is known to herpetologists for his numerous papers on salamander life history and taxonomy, and for a classic work on fossil frogs. We are indebted to Mr. William T. Innes for the loan of the accompanying cut of Dr. Wolterstorff.

News Items

THE third AMERICAN WILDLIFE CONFERENCE is scheduled for February in Baltimore. Sessions for the discussion of fish management problems are being planned.

DR. EDWARD SCHNEBERGER has been promoted to the headship of the new Division of Biology of the Wisconsin Conservation Department, and is laying plans for extension of fisheries research in that state.

DR. OSGOOD SMITH, formerly of the United States Forest Service, New Hampshire, has been appointed Assistant Aquatic Biologist with the California Trout Investigation of the United States Bureau of Fisheries.

At the meeting of the International Association of Game and Fish Conservation Commissioners, held in [illegible] City August 26, TALBOTT DENMEAD, Law Enforcement Officer of the United States Bureau of Fisheries, was unanimously elected General Counsel.

MR. GILBERT P. WHITLEY, Curator of Fishes in the Australian Museum, Sydney, will visit the United States this winter.

DR. WILLIS H. RICH, of the Natural History Museum, Stanford University, will begin his sabbatical year beginning next spring, and for at least part of the year, will act as Director of Scientific Research for the Oregon State Fish Commission. His headquarters will be at Bonneville.

DR. WILLIAM BEEBE, accompanied by MR. JOHN TEE-VAN and MISS JOCELYN CRANE, has recently sailed from San Diego on Templeton Crocker's yacht *Zaca* for a 5 months' expedition along the west coast of Central America.

The 24th regular session of the NORTH AMERICAN COUNCIL OF FISHERY INVESTIGATIONS was held in Montreal from September 23 to 25. New research projects sponsored by the Council and reported on for the first time include an extensive study of the migrations of the Atlantic salmon conducted on a cooperative basis by Newfoundland and Canada.

DR. HOBART SMITH is employed as a special assistant to Dr. Howard K. Gloyd, at the Chicago Academy of Sciences, in connection with the work on the North American snake fauna planned by the late Frank N. Blanchard, with Dr. Gloyd.

MR. J. R. KINGHORN, of the Australian Museum, is visiting American museums under a Carnegie Foundation grant, to study museum methods and educational activities.

Zoological Record

THE preparation of the ZOOLOGICAL RECORD is an indispensable service to zoological research, and the separate publication of the divisions for various major groups of animals makes them accessible to individuals. Publication is announced of the separate divisions for 1936, Vol. 73; the section for amphibians and reptiles is 3/2, for fishes 3/6; postal orders should be sent to The Zoological Society of London, Regents Park, N. W. 8, London.

Corrections

IN COPEIA, No. 2, 1937, in the article on *Necturus* by Percy Viosca, Jr., pp. 120–138, various errata occurred: on p. 130, the figure of *Necturus punctatus* is larger than natural size; on p. 131, line 38, read *specimens* for species; on p. 132, line 23, read *river* for water; on p. 136, line 3, read *of* for by; on p. 138, line 25, read *Mississippi* for Missouri.

A revised price list for COPEIA has been prepared: complete sets of the old series (Nos. 1 to 173, 1913 to 1929, with indices) $34.00; Nos. 1 to 101, 1913 to 1921, with indices, $10.27; Nos. 1 to 51, 1913 to 1917, with index, $4.00.

Recent Deaths

THE death is announced of the distinguished German zoologist DR. LUDWIG PLATE, known ichthyologically for his collections in Chile and for his publications on the lampreys of that country.

News has been received of the death of DR. P. N. VAN KAMPEN, on July 3, 1937, in Leiden. Dr. van Kampen, known to herpetologists more especially for his investigations of the East Indian fauna, had resigned, because of ill health, from the Rijksmuseum van Natuurlijke Historie in 1931.

DR. JUNIUS HENDERSON, for thirty years curator of the museum at the University of Colorado, died on November 4, at the age of seventy-two.

DR. GEORGE ALBERT BOULENGER, who, in recognition of his outstanding contributions to herpetology and ichthyology, was the first Honorary Member to be elected to our Society, died on November 23, aged seventy-nine. An account of Dr. Boulenger's life and work will appear in a subsequent issue of COPEIA.

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